An Integrated Conceptual Framework of Cloud Computing Adoption in Small and Medium-sized Enterprises in India

A Thesis submitted for the award of degree

of

DOCTOR OF PHILOSOPHY

By

Devesh Kumar

(Registration No. 951013007)

Under the supervision of

Dr. Harsh Vardhan Samalia

Associate Professor

Rajiv Gandhi Indian Institute of Management, Shillong (Meghalaya), India

and

Dr. Piyush Verma

Associate Professor

L.M. Thapar School of Management, Thapar Institute of Engineering and Technology University, Patiala (Punjab), India

L.M. Thapar School of Management

Thapar Institute of Engineering and Technology University, Patiala (Punjab), India

November 2017

Declaration

I certify that this thesis titled **"An Integrated Conceptual Framework of Cloud Computing Adoption in Small and Medium-sized Enterprises in India"** is my original research work. This work has not been previously submitted by me to any other university or institute for award of any degree or diploma. Any material previously published or written by any other author included in the text has been duly acknowledged and referenced in this thesis.

Devesh Kumar

Registration No. 951013007

Date: 27/11/2017

Certificate

This is certified that **Mr. Devesh Kumar, Registration No. 951013007** has completed his Ph.D. thesis titled **"An Integrated Conceptual Framework of Cloud Computing Adoption in Small and Medium-sized Enterprises in India"** under our supervision. This Ph.D. thesis is an authentic research work carried out by him and it is being submitted to **L.M. Thapar School of Management, Thapar University, Patiala (Punjab)** for the award of the degree of **Doctor of Philosophy (Ph.D.)**. To the best of our knowledge, this research work has not been submitted to any other university or institute for the award of any degree or diploma.

Dr. Harsh Vardhan Samalia
Associate Professor,
Rajiv Gandhi Indian Institute of Management,
Shillong (Meghalaya), India.

Dr. Piyush Verma
Associate Professor,
L.M. Thapar School of Management,
Thapar University, Derabassi Campus,
Derabassi, Mohali (Punjab), India

Date: 27th Nov. 2017.

Acknowledgements

Many people in various roles have helped me in completing this research work. First of all, I express my sincere gratitude to Gurudeva Sri Paramhansa Yogananda for his supreme guidance towards self-realization and God. I am heartily thankful to my advisors Dr. Harsh Vardhan Samalia and Dr. Piyush Verma who have guided me in every stage of this study through their valuable inputs and suggestions. I am thankful to all the faculty members at LM Thapar School of Management for extending their help in various ways during the course of this study. My special thanks to my friends Deviender Narang, Sunil Narwal and Ajay Kant Sharma for their support in the data collection stage. Finally, no words to express the gratitude I owe to my parents, my wife Pushpa, my sons Monti and Nikhlu for their continuous and earnest love, support, motivation, and encouragement for successfully completing this study.

Abbreviations used in the thesis

Abbreviation	Full form
AGFI	Adjusted Goodness of Fit Index
AVE	Average Variance Extracted
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CII	Confederation of Indian Industry
CR	Composite Reliability
DF	Degree of Freedom
DOI	Diffusion of Innovation
GFI	Goodness of Fit Index
IaaS	Infrastructure as a Service
ICT	Information and Communication Technology
IFI	Incremental Fit Index
IS	Information System
IT	Information Technology
MSME	Micro Small and Medium Enterprise
MSV	Maximum Shared Variance
PaaS	Platform as a Service
RMSEA	Root Mean Square Error Approximation
SaaS	Software as a Service
SEM	Structural Equation Modeling
SME	Small and Medium Enterprise
TAM	Technology Acceptance Model
TLI	Trucker Louis Index
TOE	Technology Organization Environment
TPB	Theory of Planned Behavior
TRA	Theory of Reasoned Action
UTAUT	Unified Theory of Acceptance and Use of Technology
VIF	Variance Inflation Factor

ABSTRACT

Cloud computing is an innovative way of delivering relevant information and communication technologies (ICTs) to customers on demand and on a pay-per-usage basis through the internet. By using cloud computing, organizations get easy and affordable access to the latest ICTs, which subsequently help enterprises in refining their internal business procedures, enabling quicker communication with clients and improved and wider market reach. Besides providing relevant ICTs to the organizations in a cost effective manner, cloud computing offers various other benefits in the form of improved business continuity and back-up, easier implementation and maintenance process, and automatic provisioning of ICT resources as per the demand. All these benefits make cloud computing an attractive option for all such organizations which are looking for making optimum utilization of latest ICT without making heavy investments.

Small and Medium-sized Enterprises (SMEs) in developing economies like India face many challenges in the form of limited capital, lack of skilled manpower, and low ICT usage. Due to these constraints, SMEs are not able to reap various benefits which modern ICT solutions offer. In such a scenario, cloud computing can be an appropriate option for such SMEs which are looking for improving their internal processes, communication with clients and business partners, and market reach through modern ICT solutions at minimum cost and efforts. Cloud computing thus, has a special significance for SMEs. Cloud computing, especially the public cloud, is particularly beneficial for such organizations which have limited finances, expertise and other resources required for implementing and using relevant ICTs.

In spite of many benefits, the literature suggests that a very few SMEs have adopted cloud computing in developing economies like India (Malviya and Chakarborty, 2013; Bhat, 2013). Due to the novelty of this innovation which is rapidly evolving, a limited number of studies are there in the literature on cloud computing adoption by SMEs, especially in a developing economy context like India. Various theoretical models, constructs, and methodologies are used by researchers to assess important factors influencing adoption of cloud computing by SMEs (Al-Isma'ili *et al.*, 2016; Prasad & Green, 2015; Khan and Al-Yasiri, 2016; Abdullah & Hassan, 2015; Alshamaila *et al.*, 2013). However, no studies are found on cloud computing adoption by SMEs in an Indian context that are established on a strong theoretical basis, which incorporate all the important factors relevant to the situation and which are empirically tested using powerful statistical techniques like structural equation modeling.

This study is an attempt towards assessing important factors influencing SME's intention to adopt cloud computing in an Indian context. A comprehensive and integrated model founded on Technology Acceptance Model (TAM), Diffusion of Innovation (DOI) theory, and Technology-Organization-Environment (TOE) framework is developed to assess the determinants of cloud computing adoption among SMEs. Data collected from 298 SMEs in India is used for this purpose. Structural equation modeling and confirmatory factor analysis are used to test model fit and to examine the related hypotheses.

The results indicate that external pressure, service providers' support, top management support, relative advantage, and security and privacy are the important determinants of cloud computing adoption among SMEs. The study is thus, a distinct attempt and important contribution towards understanding the adoption of innovations like cloud computing among SMEs.

Key words: Cloud computing, SMEs, MSME, India, adoption, TOE framework

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

STUDY BACKGROUND

1.1 Introduction

Cloud computing is an innovative mode of delivering appropriate information and communication technologies (ICTs) to customers on demand and on a pay-per-usage basis through the internet. It is well-proven fact that adoption of ICT helps organizations in streamlining their processes, improving quality and increasing their market reach. Cloud computing has the potential to make available the necessary ICT infrastructure to enterprises in the most cost effective manner. In addition, cloud computing also provides improved back-up and business continuity services, automatic provisioning of resources as per the requirement and hassle-free implementation and maintenance (Armbrust *et al.,* 2010). All such benefits and features make cloud computing a valuable option for organizations.

For Small and Medium-sized Enterprises (SMEs), cloud computing has special significance. In developing nations, SMEs are considered as the growth engine of the economy. However, at the same time, SME sector faces many challenges in the form of limited capital, lack of skilled manpower, lower productivity, inefficient business processes and marketing strategies, increased competition and low level of ICT penetration (Shiralashetty, 2012; Singh *et al*., 2010; CII, 2015). Adopting appropriate ICT can help SMEs in improving their essential business processes and solve most of the problems in an effective manner. However, very high cost and expertise associated with using and maintaining a modern ICT infrastructure hinder SMEs from adopting ICTs (Tan *et al.,* 2009). Though, with cloud computing, the situation is expected to change phenomenally. Cloud computing has potential to make available modern and relevant ICTs to SMEs without making heavy investments and efforts. Through cloud computing, ICT penetration and usage among SMEs is expected to get a boost, which would ultimately help SMEs in reaping various benefits of ICT adoption. The benefits derived from ICT adoption through cloud computing will further enable SMEs to become more competitive and agile to rapidly changing market conditions.

Despite many benefits of cloud computing, the literature suggests that a very few SMEs have adopted cloud computing, especially in developing economies like India (Malviya and Chakarborty, 2013; Bhat 2013). Due to the novelty of cloud computing, which is rapidly evolving, a limited number of studies exist on adoption of cloud computing by SMEs, especially in a developing economy context like India. Various theoretical models, constructs,

and methodologies are used by researchers to assess important factors influencing adoption of cloud computing by SMEs in some of the research studies found on cloud computing adoption (Al-Isma'ili *et al.,* 2016; Prasad & Green, 2015; Khan and Al-Yasiri, 2016; Abdullah & Hassan, 2015; Alshamaila *et al.,* 2013). A common limitation reported in these studies is the use of an inadequate set of variables relevant to the subject and context. Moreover, no other study is there on cloud computing adoption by SMEs in an Indian context that is established on a strong theoretical basis, which incorporate all the significant factors relevant to the situation and which are empirically tested using powerful statistical techniques like structural equation modeling. Therefore, a more comprehensive model founded on prominent and relevant technology adoption theories covering all the essential variables is required to be developed and empirically validated by using the appropriate and powerful statistical techniques such as confirmatory factor analysis (CFA) and structural equation modeling (SEM). The variables selected should be relevant to the technology i.e. cloud computing and its adoption among SMEs. Owing to these facts and in order to gain a richer understanding of cloud computing adoption process, the present study attempts to assess determinants of cloud computing adoption among Indian SMEs. The study employs and integrates three prominent theoretical models for this purpose. The findings of this study are expected to make significant theoretical and practical contribution in the domain of firm-level ICT adoption among SMEs.

This chapter starts with presenting a brief background of the present research study. The concept of cloud computing is elaborated in the next section which covers details like the definition of cloud computing, cloud computing delivery and deployment models, benefits of cloud computing, and concerns associated with adopting cloud computing. A brief overview of Indian SMEs sector is provided in the following section. ICT adoption and usage detail among Indian SMEs are provided in the subsequent section. The rationale of the study and a brief overview of research is presented in the following sections.

1.2 Cloud computing

Cloud computing has been defined by various authors and institutes in many ways. There is no standard definition of cloud computing. Cloud computing can be thought of as a new and innovative way of delivering ICT resources to customers on demand and on a pay-per-usage basis through the internet. Cloud computing has the potential to revolutionize the way ICT resources are acquired, utilized and maintained in the organization. Cloud computing refers to delivering software and hardware resources as a service through the internet on a pay-per-usage

basis (Armbrust *et al.*, 2010). Using cloud computing eliminates the need for buying and maintaining complex ICT systems within the organization's premises (DeFelice, 2010). Buyya *et al.* (2009) have described cloud computing similar to parallel and distributed computing which comprises a collection of connected and virtualized computing resources that are offered to customers as service that can be dynamically provisioned, regulated and governed by mutual negotiations and service level agreements between the cloud service providers and consumers. A summary of some of the definitions of cloud computing found in the literature is presented in Table 1-1.

Table 1-1 Definitions of cloud computing

Definition	**Reference**
"Cloud computing refers to both applications delivered as services through the internet and the hardware and system software in the data centers that provide those services and cloud has been referred to as the data center hardware and software."	Armbrust *et al.*, 2010
"Cloud computing encompasses a whole range of services and can be hosted in a variety of manners, depending on the nature of services involved and the data/security needs of the contacting organizations."	Wyld, 2010
"A style of computing in which scalable and elastic IT-enabled capabilities are delivered as a service to external customers using internet technologies."	Gartner 2009
"A pool of abstracted, highly scalable, and managed infrastructure capable of hosting end-customer applications and billed by consumption."	Truong, 2010
"A means of renting computers, storage and network capacity on an hourly basis from some company that already has these resources in its own data center and can make them available to a company and company's customers via the internet."	Smith, 2009
"A type of parallel and distributed system consisting of a collection of interconnected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service level agreements established through negotiations between the service providers and consumers."	Buyya *et al.*, 2009
"An information technology service model where computing services (both hardware and software) are delivered on-demand to customers over a network in a self-service fashion, independent of device and location."	Marston *et al.*, 2011
"A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction."	NIST, 2011

The definition specified by the National Institute of Standard and Technology (NIST) is found most suitable and comprehensive in the present context. Therefore, the definition given by NIST is considered in this study to describe cloud computing. NIST describes cloud computing as "a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction". NIST has specified three main cloud computing service models which are – Cloud Infrastructure as a service (IaaS), Cloud Platform as a service (PaaS) and Cloud Software as a Service (SaaS). Four cloud deployment models which are further mentioned by NIST include – Private cloud (where cloud infrastructure is operated solely for one particular organization), Community cloud (where the cloud infrastructure supports a specific community and is shared by several organizations of that community), public cloud (where cloud infrastructure is made available to the general public) and hybrid cloud (a composition of two or more clouds that remain unique entities but are bound together by standardized or proprietary technology). All these models are briefly described in the following section.

1.2.1 Cloud computing model

Various types of ICT infrastructure is provided through cloud computing. Depending upon the type of software or hardware provided, there are three forms of cloud computing service delivery models-Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS). Similarly, based upon the ownership of the ICT infrastructure, there are three cloud computing deployment models. Both of the cloud computing service delivery models and cloud computing deployment models are defined in the following section.

1.2.1.1 Cloud computing service delivery models

Based on the type of service offered, there are three service delivery models which are Software as a Service (SaaS), Platform as a Service (PaaS), and Infrastructure as a Service (IaaS) as shown in Figure 1.1.

Software as a service (SaaS): It is a multi-tenant platform which uses common resources and a single instance of both the object code of an application and underlying databases which can support various customers simultaneously. In this model, applications are delivered as a service

through internet thereby freeing the user from complex hardware and software management (Rimal *et al.,* 2011; Sultan, 2011).

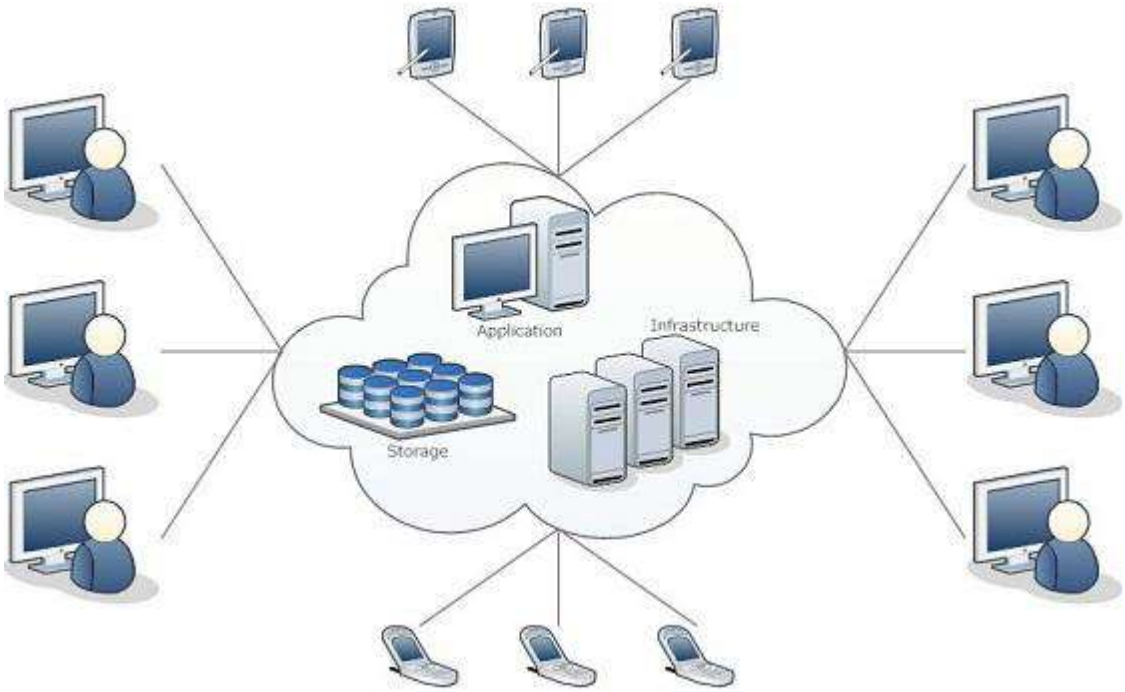

Figure 1.1 Cloud service delivery models

Platform as a service (PaaS): In this model operating systems, databases, middleware, web servers and other software are provided remotely as a service by cloud providers. The main objective in PaaS model is to provide developers a platform including all the systems and environment comprising the end-to-end life cycle of developing, testing, deploying and hosting of sophisticated web applications as a service delivered by a cloud based platform (Rimal *et al.,* 2011).

Infrastructure as a Service (IaaS): In IaaS model, the computing services offered comprise of the online delivery of full computer infrastructure such as servers, storage, and other hardware. The main advantage of this model is that the users are not required to invest in building and managing the IT system hardware.

1.2.1.2 Cloud computing deployment models

Cloud deployment models refer to a specific type of cloud computing environments which are mainly distinguished by ownership, size, and access. There are four such deployment models as represented in Figure 1.2.

Private cloud: Cloud infrastructure in this model is operated solely by one particular organization and managed by the organization or a third party regardless whether it is located on premise or off premise.

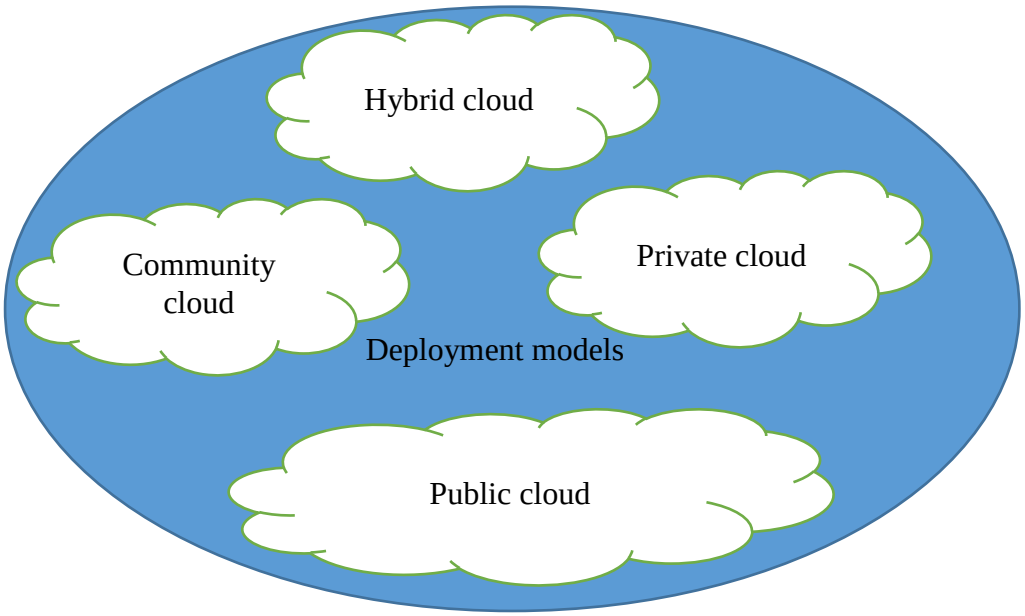

Figure 1.2 Cloud deployment models

Community cloud: In this deployment model, the cloud infrastructure supports a specific community and is shared by several organizations of that community (Wyld, 2010). In community cloud model, several organizations jointly construct and share the same cloud infrastructure which could be hosted by a third party vendor or within one of the organizations in the community (Dillon *et al.*, 2010).

Public cloud: In the public cloud deployment model, the cloud based applications are offered to the common public or companies and is possessed by an organization that sells cloud services (Wyld, 2010). Through public cloud, computing capabilities are provided as a service to the customers who are external to the service provider's organization. Public cloud computing offers benefits like economy of scale, sharing of resources, cost reduction, and bigger variety of computing services to the providers and customers.

Hybrid cloud: The hybrid cloud refers to a cloud infrastructure which is made-up of two or more cloud deployment models that remain unique entities but are bound together by a standardized or proprietary technology that enables data and application portability (Wyld, 2010).

Out of the four deployment models, public cloud model is the most extensively used and famous model and in fact, considered as a true form of cloud computing. For SMEs, public cloud deployment model is best suited, keeping in view their computing requirements and limited capital available for ICT adoption (Salam *et al.*, 2011). Therefore, in this study, the term cloud computing refers mainly to public cloud deployment model.

A brief overview of cloud computing environment consisting of its definition, major characteristics, three cloud service models, four cloud deployment models and security issues are depicted in Figure 1.3.

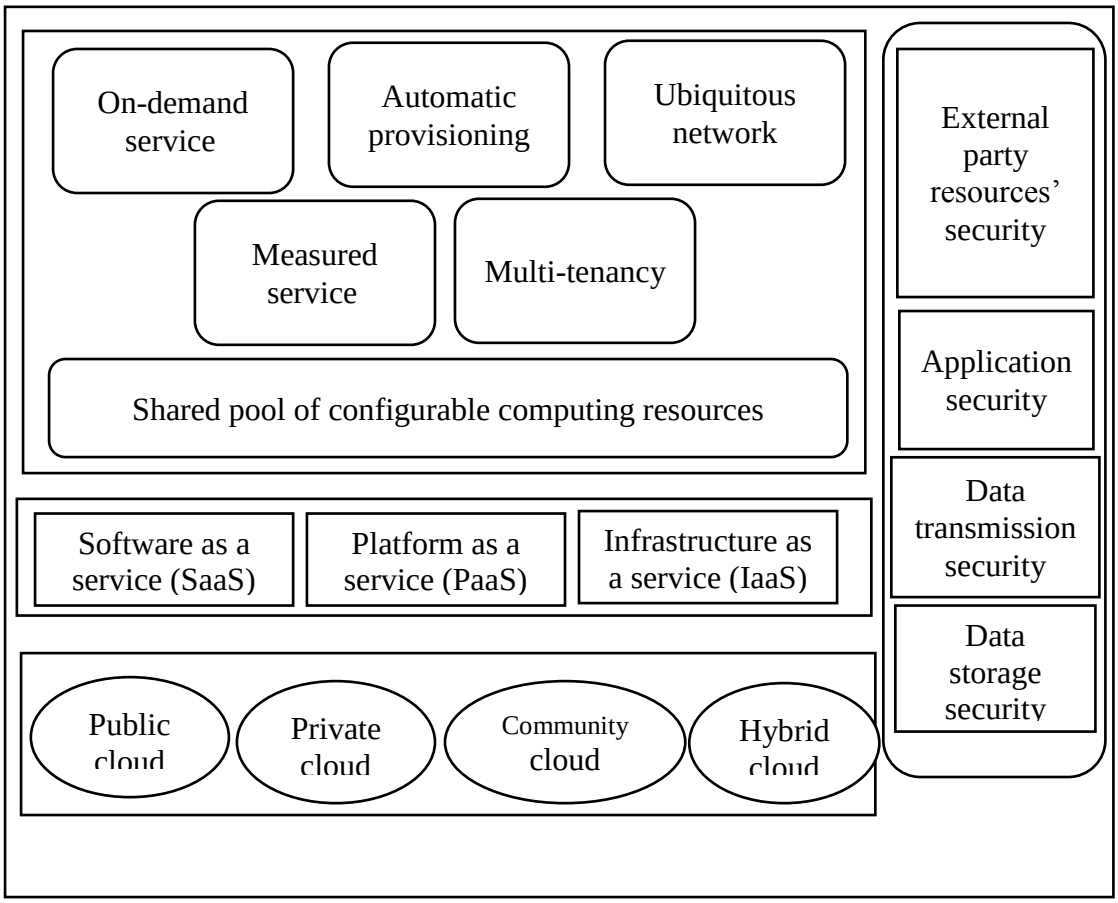

Figure 1.3 Cloud computing environment (Adapted from NIST, 2011; Subashini and Kavitha, 2011)

1.3 Cloud computing benefits for organizations

Cloud computing can prove to be a very reliable resource when it comes to solving business challenges faced by organizations, especially by SMEs. Challenges such as expensive IT, mobility restrictions, and limited growth capacity can be solved by migrating to cloud computing and exploiting SaaS/IaaS/PaaS programs to the best of their benefits. It provides a

valuable alternative to expensive and resource intensive in-house IT solutions. High overheads can be avoided by organizations by effectively utilizing cloud computing. Major benefits of cloud computing identified from the literature are summarized in Table 1-2.

Table 1-2. Cloud computing benefits

Sr. No.	Benefit	Description	Reference
1.	Cost benefits	Lower cost is the main benefit of cloud computing because in cloud computing customers pay only for what they use, customers avoid capital expenditure in ICT infrastructure and they avoid costs for maintaining the ICT infrastructure, the support staff to maintain the resources and the software licensing costs.	Marston *et al.*, 2011; Olveira et al., 2014
2.	Simplicity	Technical complexities related to ICT infrastructure set-up, operations and maintenance are taken care by the cloud computing provider, thereby reducing the burden on the SMEs to be equipped with technical knowledge. SMEs can thus focus on their core business.	Goodburn and Hill, 2010; Marston *et al.*, 2011
3	Affordability	Business applications like Customer Relationship Management (CRM) programs, Enterprise Resource Programs (ERP), and business analytics are very expensive to acquire, install and maintain. In a cloud computing model, these kinds of applications become much more affordable.	Bajenaru, 2010; Sultan, 2013
4.	Scalability	Scalability means greater flexibility, customers can easily add as much capacity as they need allowing for improved business performance.	Smith, 2009; Ryan and Loeffler, 2010
5.	Quick implementation process	In takes only a few days or in some cases hours to implement an application in a cloud.	DeFlice, 2010; Marston *et al.*, 2011
6.	Improved business continuity	Cloud Computing makes it easier for organizations to introduce business continuity and disaster recovery capabilities.	DeFlice, 2010; Zessis and Lekkas, 2012

1.4 Cloud computing adoption concerns

Due to the novelty of this emerging computing model and also due to the very special nature of cloud computing, certain concerns have also been raised. These concerns, if not addressed properly, may hinder the adoption of cloud computing by organizations. The major concerns of cloud computing are summarized in Table 1-3.

Table 1-3. Cloud computing adoption concerns

Sr. No.	Concern	Description	Reference
1.	Security & Privacy	Due to the nature of cloud computing with its multi-tenancy and shared resources characteristics, there is a big concern for businesses of failure in the infrastructure potentially exposing important information.	Sultan, 2011; Yeboah-Boateng and Essendoh, 2014
2.	Loss of control	Cloud Computing means that an organization give-up some control on IT related applications and activities . This makes the organization dependent on service provider.	Yeboah-Boateng and Essendoh, 2014
3.	Vendor Lock-in	Vendor lock-in refers to a situation in which a cloud customer is stuck to current cloud vendor due to the complexity in switching to another cloud vendor.	Armbrust, 2010; Dillon *et al*., 2010
4.	Availability & performance	Organization's concern about availability and performance of cloud services.	Armbrust, 2010; Dillon *et al.*, 2010
5.	Internet connectivity & its speed	Internet connectivity, speed, and availability are the most crucial requirement for utilizing cloud computing services.	Yeboah-Boateng and Essendoh, 2014, Abdollahzadehgan *et al.*, 2013

1.5 Indian SME sector

For the purpose of this study, the definition provided by Ministry of Micro Small and Medium Enterprises, Government of India, is used to denote SMEs. According to this definition (MSMED Act 2006), SMEs are defined based on investment in plant and machinery (Table 1-4).

Table 1-4. Definition of SME

Manufacturing sector	
Type of enterprise	Investment in plant and machinery
Micro	up to ₹ 2.5 million
Small	is more than ₹ 2.5 million but not more than ₹ 50 million
Medium	more than ₹ 50 million and less than ₹ 100 million
Service sector	
Type of enterprise	Investment in equipment
Micro	up to ₹ 1 million
Small	more than ₹ 1 million and less than ₹ 20 million
Medium	more than ₹ 20 million and less than ₹ 50 million

Micro enterprises are those manufacturing firms where investment up to ₹ 2.5 million is made (for service firms limit is ₹ 1 million); Small enterprises are those where investment in plant

and machinery is more than ₹ 2.5 million but not more than ₹ 50 million (for service firms investment is more than ₹ 1 million and less than ₹ 20 million); Medium enterprises are those where investment more than ₹ 50 million and less than ₹ 100 million is made in plant and machinery (for service firms investment is more than ₹ 20 million and less than ₹ 50 million).

Micro, Small and Medium Enterprises (MSME) sector is rapidly emerging as an extremely exciting and dynamic sector of the Indian economy. Besides providing significant support in the development of the national economy, MSMEs are also playing a vital role in the industrialization of rural & backward areas, reducing regional disparities and thereby assuring more reasonable distribution of national income and wealth. MSMEs are complementing large industries in the form of ancillary units. The MSME Sector in India consists of 36 million units which offer employment to over 80 million people, through about 6,000 products. This sector contributes about 8% to GDP, 45% to the entire manufacturing output and 40% to the exports from the country (Annual Report-2014-15, Government of India, Ministry of Micro, Small and Medium-sized Enterprises). The government of India is providing support services to MSME through various agencies like- Office of Development Commissioner (MSME), Khadi and Village Industries Commission, Coir Board, National Small Industry Development Corporation Ltd., National Entrepreneurship Development Institute and National Board for Micro, Small and Medium Enterprises. Three major trade bodies are also making a significant contribution towards promotion and development of MSME sector, and these are- Confederation of Indian Industries (CII), Associated Chamber of Commerce (ASSOCHAM) and Federation of Indian Chamber of Commerce and Industry (FICCI).

1.6 ICT adoption among Indian SMEs

SMEs in developing countries face many challenges in the form of inadequate finance, inaccessibility to appropriate technology, low production ability, ineffective marketing tactics, inability to modernize and expand, and absence of affordable and trained manpower (Shiralashetty, 2012). It is quite evident from the literature that proper and effective utilization of ICTs can help SMEs in dealing with many of these challenges, thus making SMEs more competitive and productive. ICT can help SMEs to cut cost by streamlining their business processes, improved and faster communication with their clients and enhanced product distribution by utilizing online channels.

In order to become more competitive and agile, Indian SMEs are rapidly re-innovating themselves. Traditional people driven processes used in SMEs are being transformed into technology driven processes. SME owners' outlook towards ICT solution is changing. ICT service providers are also attracted towards the potential of this untapped business segment. The emergence of cloud computing is further fuelling this trend and is definitely going to help in increasing the penetration and usage of ICTs among SMEs. However, some unique characteristics of Indian SME sector such as owner-driven business model, lack of standardized processes, and inadequate awareness about ICT benefits prevent most SMEs from adopting relevant ICTs. Other factors like lack of top management support, a high cost of ICT solution, and the lack of skilled manpower further challenge the adoption of ICT among SMEs at a larger scale (NASSCOM, 2014). Various studies carried out by Indian industry bodies have also emphasized the importance of ICT for SMEs and it is also highlighted that penetration and adoption of ICT by Indian SMEs is rather very low (CII, 2015; FICCI 2012; NASSCOM 2010).

1.7 Rationale of the study

INTUIT, a technology firm helping small businesses round the world, in partnership with the Indian government's Ministry of MSME, the National Institute of Entrepreneurship and Small Business Development (NIESBUD), and the National Small Industries Corporation (NSIC) carried out a study to gain an extensive understanding of the barriers to technology adoption among MSMEs in India and recommended a multi-stakeholder solutions to address the obstacles identified. The INTUIT study following primary data covered 728 MSMEs from 12 cities in India. Five top barriers to ICT adoption by Indian SMEs revealed in the study included – high cost of ICT solutions, absence of experienced manpower, unawareness about ICT and its benefits, data security and privacy concerns, and poor power and telecommunication infrastructure (INTUIT and Ministry of MSME, Government of India 2012). Tackling cost barriers through cloud computing, making ICT solutions more affordable and easy to adopt, sharing best practices and success stories and handling security and privacy issues through the cloud were some of the important solutions recommended in this study. Cloud computing is strongly recommended as the most appropriate solution to tackle most of the obstacles identified in this study. Various other studies have also advocated the use of cloud computing by SMEs for accomplishing their ICT requirements and also to promote strategic usage of ICT in a cost effective way (Smith, 2009; Bajenaru, 2010; Truong, 2010; Sultan, 2010; Goodburn and Hill, 2010; Ryan & Loeffler, 2010; DeFlice, 2010; Marston *et al.,* 2011; Yeboah-Boateng and Essandoh, 2014).

Cloud computing is a recent innovation which has a huge potential of accelerating ICT adoption among SMEs. Cloud computing is expected to revolutionize the way ICT resources are delivered and utilized by customers. Being a recent phenomenon, very few studies are there on the acceptance and adoption of cloud computing by organizations, especially the SMEs (Al-Isma'ili, 2016; Prasad & Green, 2015; Khan and Al-Yasiri, 2016; Abdullah & Hassan, 2015; Alshamaila *et al.*, 2013). This innovation is, therefore, required to be further researched for its adoption by the SMEs through the lens of existing theoretical models. The studies that have attempted to evaluate factors influencing cloud computing adoption lack in formulating and empirically testing a comprehensive framework, which takes into account all the relevant factors related to the innovation and the context of the study. Owing to these facts and the research gaps found in the literature, an attempt is made in this research work to assess the determinants of cloud computing adoption by SMEs in India by proposing and empirically validating a comprehensive and holistic research framework. The study is likely to make a significant contribution towards the body of knowledge related to the adoption of information system/information technology among the organizations, SMEs in particular. The findings of the study are also likely to benefit SMEs and practitioners in their effort to increase adoption of cloud computing.

1.8 Overview of research

1.8.1 Research questions

Following are the research questions for the current study:

1. What are the factors that influence SME's intention to adopt cloud computing?
2. Which are the significant factors and what is their relative importance?

1.8.1 Research objectives

The primary objective of this research study is to develop an integrated conceptual framework of cloud computing adoption in small and medium-sized enterprises (SMEs) in India covering the SMEs mainly from three northern states- Himachal Pradesh, Punjab, and Haryana. Based on this primary objective, further sub-objectives are stated as:

- To identify and study the factors that influence adoption of cloud computing by organizations from extant literature.

- To develop an integrated conceptual framework based on the analysis of existing theoretical models, determining cloud computing adoption in SMEs in India.
- To empirically validate the developed conceptual framework.

1.8.3 Research hypotheses

Based on literature review, ten factors were found relevant for predicting SME's intention to adopt cloud computing in the present context. Therefore, ten hypotheses concerning each factor were formulated by using literature review and deductive reasoning (the detailed process described in Chapter 3, section 3.3). Following hypotheses are thus formulated for the study:

H1. Perceived usefulness positively influences SME's intention to adopt cloud computing.

H2. Perceived ease of use positively influences SME's intention to adopt cloud computing.

H3. Relative advantage of cloud computing positively influences intention to adopt cloud computing by SMEs.

H4. Compatibility positively influences intention to adopt cloud computing by SMEs.

H5. Security and privacy concerns negatively influence SME's intention to adopt cloud computing.

H6. Technology readiness positively influences SME's intention to adopt cloud computing.

H7. Top management support positively influences SME's intention to adopt cloud computing.

H8. Firm size positively influences SME's intention to adopt cloud computing.

H9. External pressure positively influences intention to adopt cloud computing by SMEs.

H10. Service providers' support positively influences SME's intention to adopt cloud computing.

1.9 Significance of the study

The study is founded on the prominent theoretical models developed for enhancing understanding of new information system adoption among organizations. This study is intended to provide new insight about adoption of cloud computing by SMEs and thus expected to make a significant contribution in the domain of technology adoption among SMEs. The

findings will help SMEs in understanding important factors to consider for adopting cloud computing and in knowing their relative advantage. Cloud service providers are also going to be benefited in understanding SMEs requirements and expectations, thereby enabling them to customize their offerings accordingly. Beside this, the study will make a significant contribution towards the body of knowledge pertaining to technology adoption in SMEs.

1.10 Organization of the thesis

This study is organized into six chapters. Chapter one presents a detailed introduction to the research study. Chapter two deals with literature review part. Chapter three explains the research methodology followed in this study. It includes details about research framework proposed, hypothesis formulation, instrument development, data collection and a brief description of the statistical analysis strategy used. Chapter four presents results of data analysis. Discussion about the findings and implications of the research are presented in chapter five. The last chapter provides a summary and conclusion of the research, limitations of the research and suggestions for future research.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

A literature review is an integral part of a research study. It provides essential insight about the research problem and the related theoretical foundation. Literature review familiarizes the researchers about the research work conducted in the area of interest. The extent of work done and limitations are revealed through literature review. Review of literature enables a researcher to identify the research gaps and helps in defining the research problem accordingly. The review further helps in establishing a foundation on which a conceptual research framework is developed which incorporates and focuses on all the important constructs relevant to the technology (cloud computing) and the context (SMEs in India). This chapter provides detail of research work undertaken in previous studies about the problem area relevant in the context of current research. The chapter starts with providing a brief overview of the prominent theories used in understanding adoption of information technologies among organizations in section 2.2. Section 2.3 includes summary of research work carried out in the area of adoption of ICT among SMEs. Section 2.4 presents a summary of research work reported in the literature on cloud computing adoption in organizations. Section 2.5 provides detail of research carried out on adoption of cloud computing in SMEs. The chapter concludes with identifying the research gaps and statement of the problem.

2.2 Theoretical foundation

Various theories are proposed and utilized to understand, predict and explain factors influencing adoption of technology at individual and firm level. Major among these are- Technology Acceptance Model (TAM), Diffusion of Innovation (DOI), the Theory of Planned Behavior (TPB), the Theory of Reasoned Action (TRA), Unified Theory of Acceptance and Use of Technology (UTAUT), and Technology-Organization-Environment Framework (TOE Framework). These theories/models are used in a number of contexts and various information systems and information technologies are studied from adoption and acceptance perspective. Three theories considered in this study include-TAM for understanding SME owner's attitude towards adopting cloud computing; DOI theory is used for understanding innovation characteristics such as the relative advantage of cloud computing over an on-premise model, compatibility, and security and privacy; TOE framework is utilized for gaining an

understanding of cloud computing adoption at the firm level. A brief overview of the major theoretical models is presented in the following section.

2.2.1 Technology Acceptance Model (TAM)

For understanding IT adoption at an individual level, TAM is considered as one of the most extensively acknowledged models (Lee *et al.*, 2003). A review study by Liu *et al.* (2008) discloses that out of total 211 research papers studied on IT adoption, TAM has been used as a theoretical foundation in 40% cases. Simplicity and effectiveness of TAM are cited as the main reasons for the dominant status of TAM. The model offered by Davis (1989) suggests that an individual's information system acceptance is determined by two major variables namely- perceived usefulness (PU) and perceived ease of use (PEOU). Perceived usefulness is defined as "the degree to which an individual believes that using a particular system would enhance his or her job performance", whereas perceived ease of use refers to "the degree to which an individual believes that using a particular system would be free of physical and mental efforts" (Davis, 1989). Figure 2.1 illustrates the TAM framework.

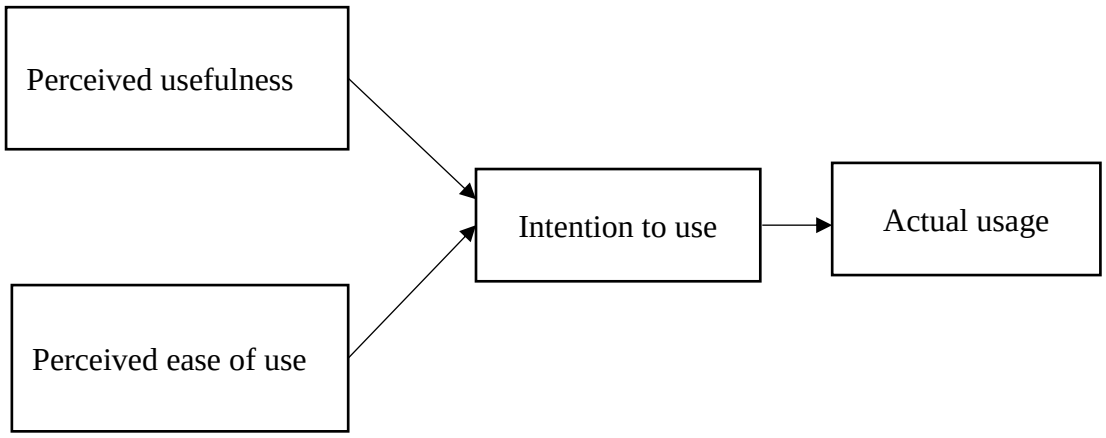

Figure 2.1 Technology Acceptance Model (Davis, 1989)

Lee *et al.* (2003) have highlighted that several researchers have utilized TAM for understanding IT adoption with diverse research objectives, themes, information systems, and tasks applying different research methodologies under dissimilar environments. PU and PEOU are thus identified as the primary determinants of information system adoption.

2.2.2 Theory of Reasoned Action (TRA)

The theory of reasoned action which stems from social psychology is considered as a distinct case of the theory of planned behavior (Ajzen, 1991). Fishbein and Ajzen (1975) established TRA to describe associations between norms, beliefs, attitudes, intentions, and behaviors of individuals. According to this theory, the behavior of an individual is governed by intention and intention itself is determined by the individual's attitude along with the subjective norms. The subjective norm refers to "the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975). Figure 2.2 displays the constructs and relations in TRA.

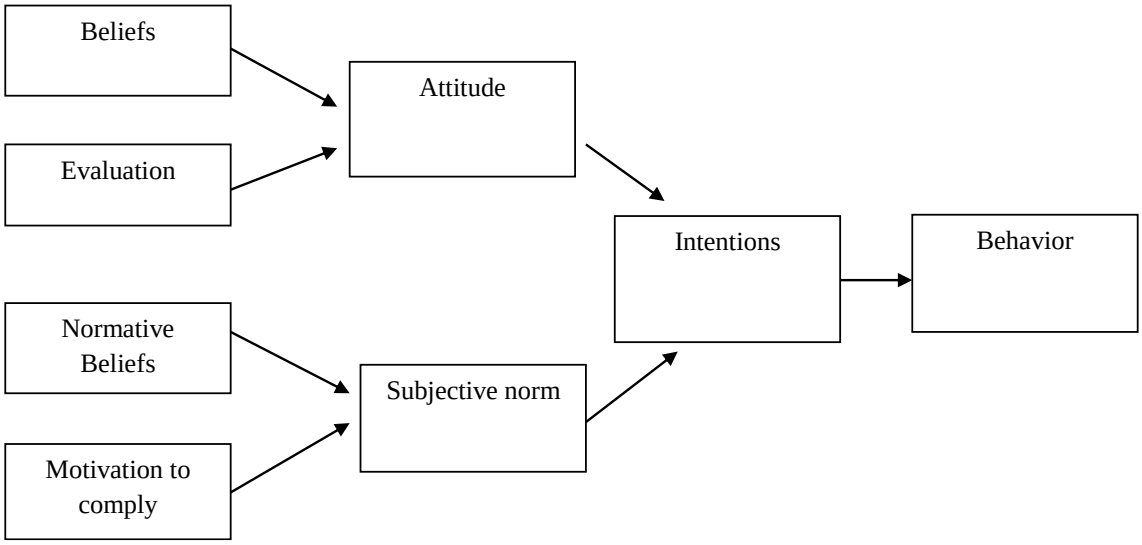

Figure 2.2 Theory of Reasoned Action (TRA) by Fishbein & Ajzen, 1975

2.2.3 Theory of Planned Behavior (TPB)

The theory of planned behavior (TPB) proposed by Azen (1991) emphasizes on mental self-regulation. The main difference between TPB and TRA is that the theory of planned behavior considers an additional factor called perceived behavior control. Perceived behavioral control is defined as "the perception of control over the performance of a given behavior". This theory asserts that human behavior is governed by intentions, which are further determined by attitude, subjective norms, and perceived behavior control. TPB thus, considers social pressure and control beliefs as equally important in determining individual's behavior. Figure 2.3 presents TPB model.

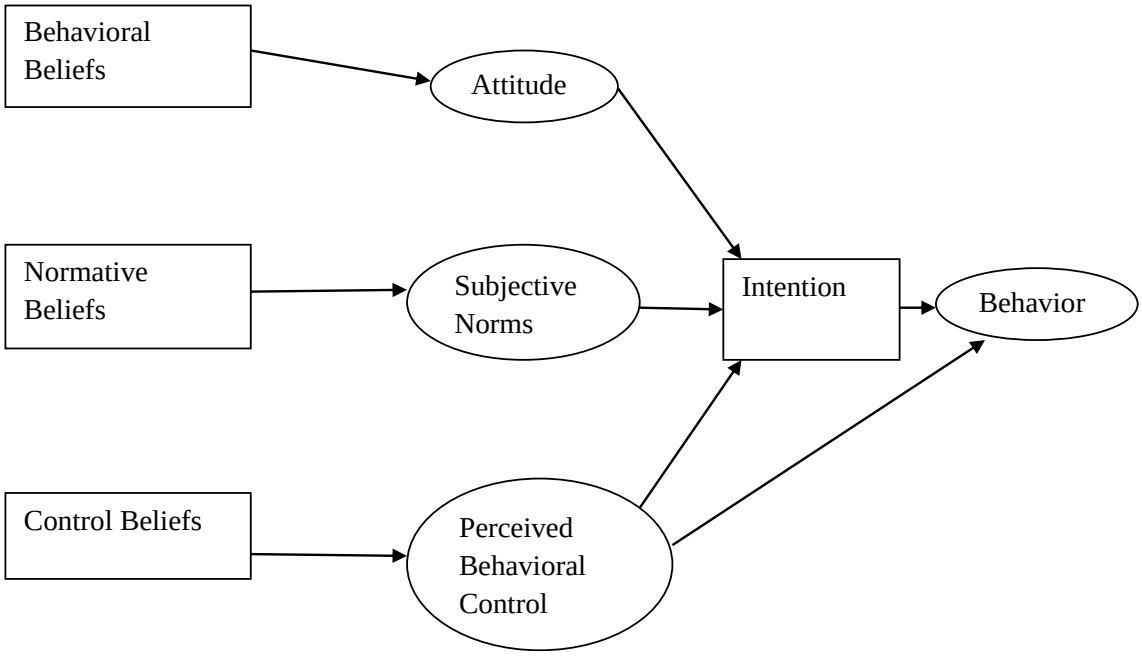

Figure 2.3 Theory of Planned Behavior (Ajzen, 1991)

2.2.4 Unified Theory of Acceptance and Use of Technology (UTAUT)

Venkatesh *et al.* (2003) proposed a new model of IT adoption by individuals on the basis of a review of existing eight models. The new model was termed as – the Unified Theory of Acceptance and Use of Technology (UTAUT). This model was developed to explain individual user's intentions to use IT. For this, four constructs were recommended in the UTAUT model, which included – "performance expectancy, effort expectancy, social influence, and facilitating conditions" (Venkatesh *et al.*, 2003). In fact, most of the variables suggested in the previous theories were incorporated into the four constructs. Social influence and facilitating conditions were the new factors proposed in this model. Facilitating conditions were found to have a direct influence on the actual use of information technology. In addition to the four constructs, some moderating variables were also proposed in this model, which consisted of – age, gender, experience, and voluntariness. The UTAUT model was empirically verified as an enhancement over the other existing models. Figure 2.4 illustrates the UTAUT model.

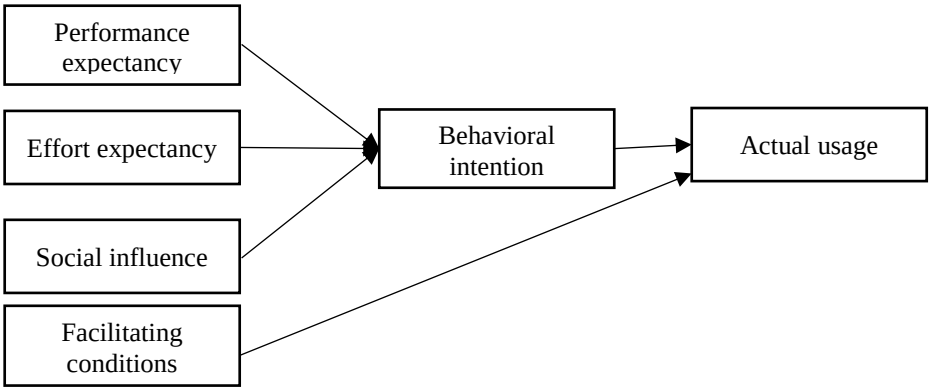

Figure 2.4 Unified Theory of Acceptance and Use of Technology (Venkatesh, 2003)

2.2.5 Diffusion of Innovation (DOI)

Rogers (2003) proposed a theory named - Diffusion of Innovations (DOI) which originated from sociology. DOI explains how innovations actually spread in an organization through various individuals working in that organization. DOI was initially regarded as a model for innovation adoption in general, but now DOI is being utilized successfully for explaining the adoption of information technology in organizations. DOI also emphasizes the role of communication channels and opinion leaders in innovation diffusion. Moore and Benbasat (1991) carried the theory over to the IS domain and expanded it to include eight independent constructs: "voluntariness, relative advantage, compatibility, image, ease of use, result demonstrability, visibility, and trialability". This model is a direct model. This makes the model suitable for testing with first generation multivariate analysis techniques. Even though the model offers a comprehensive set of constructs, later work found out that the factors consistently came up in DOI studies were the relative advantage, complexity, and compatibility (Bradford & Florin, 2003). DOI has been used and acclimated in numerous ways (Cooper and Zmund, 1990; Eder and Lgbaria, 2001; Li, 2008; Zhu *et al.*, 2006; Oliveira and Martins, 2011). Relative advantage and compatibility are found relevant in the present context. Figure 2.5 presents different characteristics of innovation that influence its adoption.

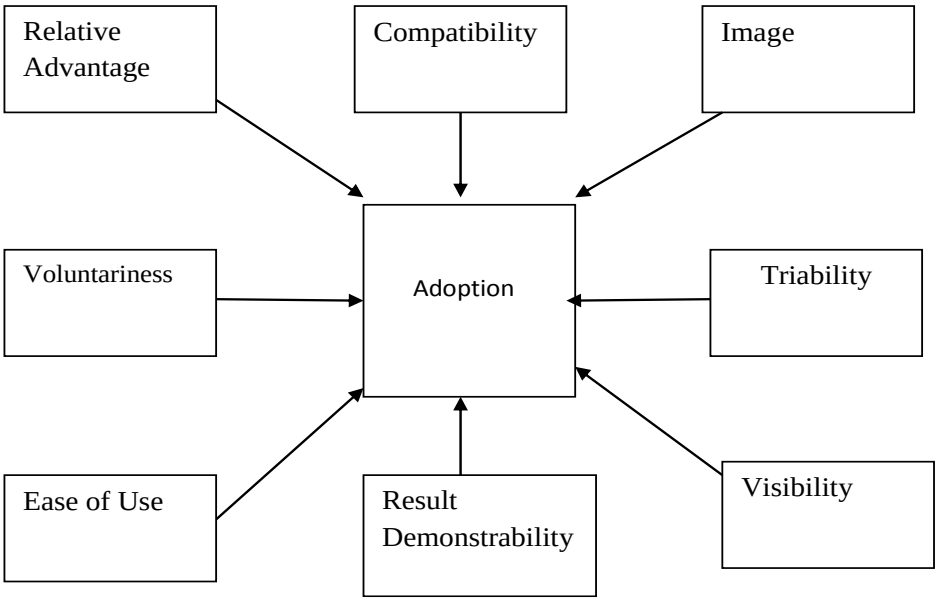

Figure 2.5 Diffusion of innovation (Rogers, 2003)

2.2.6 Technology-Organization-Environment Framework (TOE)

According to TOE framework developed in 1990 by Tornatzky and Fleischer, the firm's adoption of technological innovations is influenced by technological, organizational and environmental contexts. All the factors that influence adoption of information technology by an organization are categorized under these three contexts. Technological perspective describes the internal and external technologies available to the firm. Technological context covers all the existing practices, equipment, and technologies available to the firm. Organizational perspective denotes those organizational features which influence adoption of information systems such as size, scope, and managerial structure. Environmental context refers to the environment in which a firm carries out its business. The environmental context constitutes competitors, business partners, customers, and regulators. The TOE framework offers a valuable analytical basis that can be utilized for assessing the acceptance and assimilation of different types of IT innovation. "The TOE framework has a solid theoretical basis, consistent empirical support, and the potential of application to IS innovation domains, though specific factors identified within the three contexts may vary across different studies" (Oliveira and Martins, 2011). This model is specifically found useful at organizational level IT adoption. It has been used by several authors in order to understand different IT adoptions like open systems

(Chau and Tam, 1997); e-business usage (Zhu and Kraemer, 2005); ERP (Pan and Jung, 2008); knowledge management systems (Lee *et al.*, 2009); cloud computing (Oliveira *et al.*, 2014). Figure 2.6 presents TOE framework.

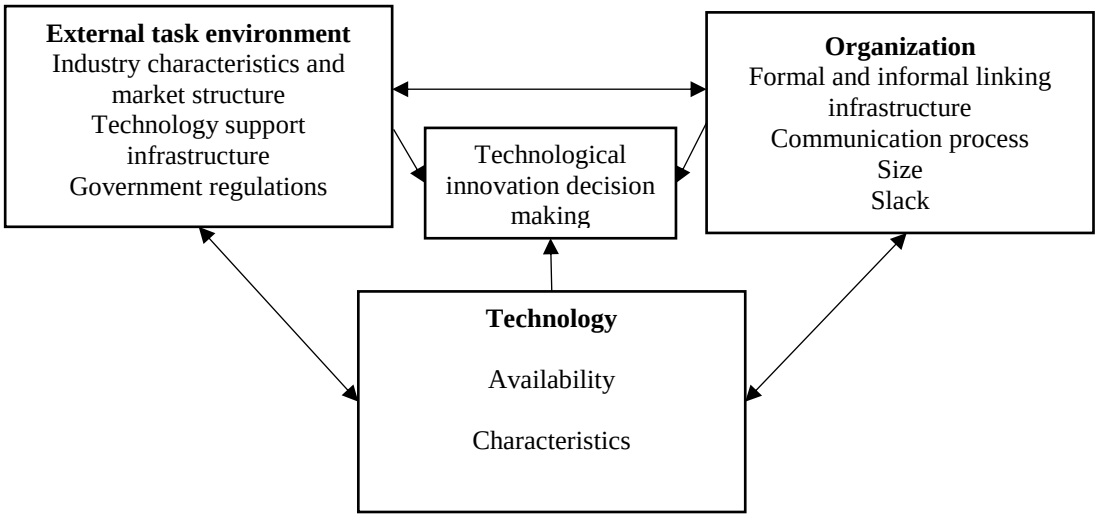

Figure 2.6 TOE framework (Tornatzky and Fleischer 1990)

These theoretical models have been used by various researchers in different contexts. Because of some of the limitations associated with a particular model, it is recommended that two or more theoretical models can also be integrated into one model in some cases depending upon the kind of the innovation and the background of the research study. Some of the models have been used more frequently to understand adoption of information technologies at individual level (such as TAM, TPB, TRA, and UTAUT) whereas some are used to understand the adoption at an organizational level (such as DOI and TOE framework). A brief summary of these models is presented in Table 2-1.

2.3 ICT adoption in SMEs

In today's competitive business environment SMEs are required to recognize technology especially, ICT as a key business driver. From being an enabler of productivity and efficiency, ICTs must be leveraged for transformation and as a key influencer of competitive advantage. The reason to include this section in the present chapter stems from the fact that through cloud computing, SMEs can adopt relevant ICTs in a very cost effective and convenient manner. Therefore, before studying the cloud computing adoption in organizations, it is necessary to

examine the status of ICT adoption among SMEs from research and practical perspectives, particularly in the Indian context. Various studied carried out in this area are summarized below.

Table 2-1. Technology adoption theories

Sr. No.	Technology adoption theory	Constructs	Contributing author(s)
1.	Theory of Reasoned Action (TRA)	Belief, intention, attitude, norms, and behaviors	Fishbein and Azen (1975)
2.	Technology Adoption Model (TAM)	Perceived ease of use, Perceived usefulness	Davis (1989)
3.	Theory of Planned Behavior (TPB)	Subjective norms, perceived behavioral control, intention, attitude	Azen (1991)
4.	Diffusion of Innovation (DOI)	Relative advantage, compatibility, image, triability, visibility, result demonstrability, ease of use, Voluntariness	Roger (1995)
5.	Unified Theory of Acceptance and Use of Technology (UTAUT)	Performance expectancy, effort expectancy, social influence, facilitating conditions, behavioral intention	Venkatesh *et al.* (2003)
6.	Technology-Organization-Environment Framework (TOE Framework)	Technology context, organizational context, environmental context	Tornatzky and Fleicher (1990)

Venkatesh *et al.* (2003) pointed out that examining user adoption of new technology is one of the most developed research areas in the existing information systems (IS) literature. Several theoretical models have been proposed to explain the acceptance of technology at an individual level. In general, these models explain over 40 percent variance in individual intention to use technology. The authors have proposed a new unified model on the basis of literature survey and empirical testing of existing eight related models. The unified model was named as the unified theory of acceptance and use of technology (UTAUT) which utilizes four constructs that include performance expectancy, effort expectancy, social influence and facilitating conditions, for explaining intention to use technology. The proposed unified model was also empirically tested and the results revealed that the model outperformed all the eight models.

Lal (2004) identified and examined factors that distinguish organizations using diverse kind of e-business technologies in the manufacturing sector in India. 51 firms from National Capital Region were surveyed, most of which (73%) were SMEs. Various constructs like entrepreneurial features, firm history, and other organization-specific aspects like firm size, export strength, international alignment, wage rates, and income margins were included in the analysis. It was found in this study that the firms which are managed by knowledgeable and qualified business persons, adopt more advanced e-business technologies. International orientation has also emerged as a significant factor in e-business technology adoption.

Barba-Sanchez *et al.* (2007) have utilized literature review to analyze the impact of ICT adoption among SMEs. The study has highlighted the current status of ICT adoption among SMEs in various countries. Objectives and challenges regarding ICT adoption are also identified. Major benefits of ICT adoption identified in the study include – increasing productivity and efficiency, access to the new environment, enhancing market reach, using new business models and improving the quality of human resources.

Bhagwat and Sharma (2007) highlighted that Indian SMEs are deprived of suitable monetary returns due to the absence of proper information system. The authors conducted a survey covering 210 SMEs from the western part of India to investigate information system practices followed in the organizations. The results of the study revealed a growing trend in information technology adoption in SMEs. An IS architecture for proper usage of IT is also proposed in this study.

Maguire *et al.* (2007) assessed how SMEs in the UK were using ICTs to gain competitive advantage. The study revealed that 70 percent of the SMEs accepted that ICT is beneficial to their businesses in many ways and there is more scope to get additional benefits by making integrated and strategic use of ICTs.

Sharma *et al.*, (2008) suggested that numerous Indian SMEs have started adopting information systems in order to compete at the global level and also to streamline and consolidate their supply chains. Data from 147 SMEs were used to examine information system practices used in these SMEs along-with assessing the influence of these practices on IS performance. IS practices followed in SMEs were factored into six latent variables ranging from information sharing to IS capabilities. Five factors were found to correlate with IS performance measures.

Thakkar *et al.,* (2008) have investigated IT adoption and implementation issue in Indian manufacturing SMEs towards enhancing the capabilities of their supply chains. They held that

SMEs can get several benefits by adopting latest ICTs in terms of reaching new customers and suppliers and also improvements in their supply chain competencies at a reasonable cost and in a simple way without making significant changes in their current business practices. Ten enabling factors for IT implementation in Indian SMEs as identified in the study are: owner orientation and commitment, complexity of managing network relationships, customer expectation, overall penetration of IT in SME cluster, inter-firm competition, understanding on benefits of IT, availability of SME specific IT packages, financial assistance from government and other bodies, internal culture of the organization and impact of IT on competitiveness of the firm.

Dai (2009) has made an attempt to explore the significance of latest ICT solutions for SMEs. The main obstacles which hinder adoption of advanced ICTs among SMEs are also identified. The author has proposed a simple and cost effective service framework that SMEs can utilize while adopting advanced ICT. The author held that the emerging ICTs have huge potential to transform business processes of SMEs and also in strengthening collaboration with business partners and customers at a global level. The technologies that are found suitable for SMEs are identified in this study and these are also associated to the services oriented architecture (SOA), SaaS, cloud computing, and innovative application environment which are established through the Phoenix research program at Victoria University.

Ramdani *et al.* (2009) have proposed a model that can be used to identify prospective SMEs that are going to adopt enterprise information systems such as enterprise resource planning (ERP), customer relationship management (CRM), supply chain management (SCM), and e-procurement systems. The technological and organizational factors are found to have more impact on SMEs intention to adopt enterprise systems SMEs than environmental factors. It is further shown that SMEs with a larger perceived relative advantage, greater triability, better top management support, larger organizational readiness and a bigger size are more likely to adopt enterprise systems.

A study conducted by NASSCOM (2010) recommended proper use of ICT by Indian SMEs in order to revive the manufacturing sector in India and to enhance its productivity. The study stressed that Indian manufacturing sector significantly lags behind global peers in ICT adoption. It is further revealed in this study that India's expenditure on ICT was USD 50 whereas China disbursed double of this amount in 2006. It is pointed out in this study that with the greater ease of accessibility and availability of ICT solutions, the ICT adoption among

Indian manufacturing sector is definitely going to increase. The study suggested that increasing adoption of ICT among manufacturing SMEs requires a multi-stake holder approach comprising IT organizations, manufacturing companies, government, financial institutions and academic world.

Kale *et al.,* (2010) surveyed 130 SMEs in one the most advanced cities in India and found that ERP system has been implemented in most of the SMEs and these SMEs are benefited in terms of reduction in inventory, improvement in customer services, and better communication. Besides these benefits, top management support, and the end user's participation are highlighted as the major contributor of ERP success. The study also revealed that Indian SMEs are using various other computerized information systems to reduce cost.

Srivastva, R. and Pandey, R. (2010) have tried to understand how operation management is practiced in the Indian SME sector, and how such firms' operational performance and competitiveness can be facilitated by proper design and use of information systems/ information technology and decision support systems by adopting case-based methodology. The authors observed that although the organization, technology, and management in large firms in the developing countries have caught up significantly with those in the advanced countries, the SMEs in the developing world are still quite different from their counterparts in the advanced markets. Several issues confronted by SMEs in developing country are still inadequately covered in operations management literature. Authors concluded that based on the stage at which a firm is in terms of the degree of formalization of operations and IS/IT systems, a logical development towards formal and effective systems could be predicted.

Shah Alam *et al.* (2011) have empirically examined the determinants of e-commerce adoption by Malaysian SMEs. The authors have proposed a research framework which is arrived at through literature survey. Data from 200 Malaysian SMEs are used for hypotheses testing on the adoption of e-commerce. The results indicate that compatibility, relative advantage, manager's characteristics, security, and organizational readiness have a significant influence on e-commerce adoption by SMEs.

Ghobakhloo, *et al.* (2011) have developed and empirically tested an interactive model of IT implementation success in Iran. Data from 121 SMEs from Iran is utilized for validating the research framework and for hypotheses testing. It is revealed in the study that IT adoption

success is affected by users' IT knowledge and involvement, CEO support and external assistance.

INTUIT (2012), a technology firm, helping small businesses across the world, conducted a study to explore inhibitors of technology adoption among Indian SMEs, with the help and support from the Government of India. This study following primary data covered 728 MSMEs from 12 cities in India. Five top barriers to ICT adoption by Indian SMEs revealed in the study included – high cost of ICT solutions, the absence of experienced manpower, unawareness about ICT and its benefits, data security and privacy concerns, and poor power and telecommunication infrastructure. The study recommended multi-stakeholder solutions to address the obstacles identified.

Kannabiran and Dharmalingam (2012) explored important enabler and inhibitors of advanced IT adoption among auto ancillary SMEs in India. It is revealed that adoption of advanced IT is very low as only 17 percent of SMEs covered in the survey, were found to be using advanced IT. The main enablers highlighted in this study included perceived benefits and competitive pressure, whereas the inhibitors comprised of small scale operation, lack of financial capacity, and lack of in-house IT manpower.

Ndiege, *et al.* (2012) have reviewed the literature on ICT acceptance within SMEs in developing economies. The authors established that by tactically putting their ICT, SMEs can tap into the vast possible rewards offered by ICT. SMEs can make use of their flexibility and comparatively minor size to their benefit because these are considered as the best conditions for the diffusion and application of ICT. The authors observed that appropriate application of ICTs can help SMEs in developing economies, solve some of the recurring problems they are facing. The study stressed that due to SMEs' scarce resources and a bad operating environment in their countries, SMEs in developing economies have a tough task retrieving resources required for using ICT solutions to support their enterprises.

Nguyen, *et al.* (2013) observed that the adoption rate of IT in small businesses is quite low whereas the failure rate is high. Customers are recognized as the main driving power behind the adoption of IT. The additional factors which lead to successful implementation of IT in small businesses include-internal IT resources, external IT consultants, supplier relations, and customer relations.

Hanclova *et al.* (2014) have explored factors affecting adoption of IT in MSMEs within Czech–Polish region. The basic determinants of IT adoption revealed in this work include data sources, the use of function modules in information systems, and the required IT properties and the way IT operations are implemented.

Ahmad *et al.* (2015) have investigated e-commerce adoption among Malaysian SMEs. The authors have proposed and tested eight hypotheses pertaining to the factors influencing e-commerce adoption by Malaysian SMEs. Data collected and analyzed from 307 SMEs reveals that relative advantage, compatibility, owner's knowledge, management characteristics, and external change agents affect adoption of e-commerce adoption by SMEs in Malaysia.

Hashim (2015) has examined the adoption of ICT by the owners of SMEs in Malaysia. Analysis of data obtained from 383 respondents reveals a very low level of ICT adoption by the owners of the Malaysian SMEs. The major reason behind this finding is mainly attributed to the perception that ICT solutions are difficult and complex to use. The importance of owner's perceptions, skills, and intention towards using ICT is highlighted in this study.

Rahayu and Day (2015) have empirically examined factors influencing e-commerce adoption among SMEs in Indonesia. The authors have revealed that e-commerce adoption trend and process are very different in SMEs as compared to the large enterprises. Therefore, a conceptual framework was proposed and tested keeping in view the nature of SMEs. TOE framework was utilized in this study with the addition of one more context - individual perspective. Data analyzed from 292 Indonesian SMEs indicated technology readiness, perceived benefits, IT ability, owner's innovativeness, and IT experience as the significant factors influencing e-commerce adoption.

Taylor (2015) proposed a unified framework founded on TOE and DOI for better understanding of the ICT adoption among SMEs. The author has observed that ICT adoption provides various kinds of benefits to the organizations in the form of enhanced productivity, profitability and competitiveness, but adoption of ICT among SMEs differs greatly from large enterprises. Some of the unique characteristics and facts about SMEs such as owner centric approach, informal organizational structure, and resource constraints are cited as the major reasons behind this difference of ICT adoption among SMEs and large enterprises.

A summary about ICT adoption by Indian SMEs is presented in Table 2-2.

Table 2-2. ICT adoption by Indian SMEs

Sr. No.	ICT Adoption investigated	Construct/Factors /contribution	Methods	Data and context	Author (s)
1.	e-business technologies	Entrepreneurial features, past data of firms, size of operation, export strength, international alignment, wage rates, and profit margins	Descriptive analysis	51 Indian manufacturing SMEs	Lal (2004)
2.	Information system adoption	Information system architecture for SMEs	Survey of SMEs IS related practice	210 Indian SMEs	Bhagwat and Sharma (2007)
3.	Information system practices	Information sharing, IS strategy, IS evaluation practices, management participation, IS capability	Descriptive statistics, factor analysis	147 Indian SMEs	Sharma *et al.* (2008)
4.	IT adoption	Nine factors specific to Indian context categorized into autonomous, driver, and dependent	Interpretive structural modeling	10 manufacturing SMEs	Thakkar *et al.* (2008)
5.	ERP system adoption	Information about ERP, benefits of ERP, Return on investment, facilitators and inhibitors of ERP adoption	Survey methodology, interviews	210 Indian SMEs	Kale *et al.* (2010)
6.	Impact of IS and DSS adoption on operation management	Provided a roadmap for SMEs for developing a formal operation management system supported by IT/DSS adoption	Case based methodology	11 in-depth studies on Indian SMEs	Srivastva and Pandey (2010)
7.	Barriers to IT adoption among Indian MSMEs; possible solutions	High cost of ICT solutions, absence of experienced manpower, unawareness about ICT and its benefits, data security and privacy concerns, and poor power and telecommunication infrastructure	Survey methodology, descriptive statistics	728 Indian MSMEs	INTUIT (2012)
8.	Enablers and inhibitors of IT adoption	Enablers: competitive pressure and perceived benefits; inhibitors: lack of financial capability, small scale operation and absence of in-house IT manpower inhibit the advanced IT adoption	CFA and multiple regression analysis	110 auto ancillary SMEs in India	Kannabiran and Dharmalingam (2012)

It is apparent from the literature that there is a huge potential for ICT adoption among SMEs, keeping in view the benefits which can be realized by using appropriate ICTs. However, adoption of various kinds of ICTs among SMEs is very different from large enterprises. Due to major differences in the characteristics and constraints among large enterprises and SMEs, it is recommended in the literature that different factors and theoretical models should be used to better understand ICT adoption by SMEs. Due to various constraints like the high cost of ICT applications, lack of IT literate manpower, low level of awareness of the benefits of ICT adoption, the penetration of ICT among SMEs in developing economies, especially in India, is still low.

2.4 Cloud computing adoption in organizations

This section presents a summary of various studies that are carried out in the domain of cloud computing acceptance, adoption, and usage by organizations. It highlights the theoretical basis used, factors, and findings of these studies.

Misra and Mondal (2010) have attempted to ascertain the suitability of cloud computing for organizations based on their own business activities and the existing IT resources. A model based on return on investment (ROI) is proposed in this study to check the financial viability of cloud computing for the organizations. This study provides potential adopters of cloud computing a decision-making tool, which can be used to determine the suitability of cloud computing for their business.

Subhashini and Kavitha, (2010) have mentioned security as the main apprehension inhibiting wider adoption of cloud computing by business enterprises. Major security issues identified in this study include – "data storage security, data transmission security, application security and security related to third party resources". This paper describes various security issues involved in cloud computing adoption from service delivery model perspective in detail. It has also been mentioned that several research groups like Cloud Security Alliance (CSA), Cloud Standards web site, Open Web Application Security Project (OWASP) and Open Grid Forum are working in developing security solutions and standards for the cloud. The authors suggested that there should be an appropriate security model for the smooth and safe adoption of cloud computing by the users.

Zhang *et al.* (2010) conducted a survey of cloud computing from a technical perspective covering its important notions, architectural values, advanced execution as well as research

issues. Key research challenges highlighted in the paper include- automatic resource provisioning, power management & security management. Authors believe that there is a tremendous opportunity for researchers to make a groundbreaking contribution in this field.

Cook *et al.* (2011) consider cloud computing as an emerging paradigm with rapidly growing popularity and adoption. Useful directions and guidelines about managing clouds and cloud services have been provided in the study and some issues concerning research on cloud management in near future are also forecasted. For successful adoption of cloud computing amongst organizations, a number of suggestions are provided that include cost effective, SLA compliance, security assurances, reasonable availability, energy efficiency and accurate accounting. All these requirements need effective management of cloud resources & services.

Low *et al.* (2011) have investigated factors affecting adoption of cloud computing among firms belonging to the high tech industry in Taiwan. Data from111 such firms were used for this purpose. The study revealed that top management support, relative advantage, competitive pressure, firm size, and external pressure significantly influence adoption of cloud computing in organizations.

Neves *et al.* (2011) have identified the utmost pertinent matters related to the political, economic, social and technical factors regarding cloud computing adoption. The research study is founded on the review of related literature. The research work provides an overview of the most current findings in the cloud computing environment. Major factors influencing cloud computing adoption identified in this study include –easier availability, user friendliness, universal systems, low price, a variety of options available, customer support/communication, and availability of manpower to operate and maintain the system.

Wu *et al.* (2011) have observed that organizations prefer SaaS to enhance their performance and competitiveness, however, lack of trust in cloud services and service providers obstruct organizations from adopting cloud computing. Decision Making Trial and Evaluation Laboratory (DEMATEL) method is used to develop a solution framework. A case study conducted on a Taiwanese's firm revealed that the firms are more apprehensive about the strategic-oriented benefits rather than the economic benefits.

Aljabre (2012) explored major benefits and disadvantages of cloud computing within the business realm. By making use of Amazon's cloud computing services as a model, this paper highlighted the types of industries that would benefit more from using cloud computing. Small

businesses are found to be more benefited by using cloud computing. Reduced cost, reduced manpower requirement, availability of latest technologies, improved collaboration amongst business partners are some of the benefits mentioned in the study. Major concerns pointed out in paper include- switching costs, outages and reliability of cloud services.

Cegielski *et al.* (2012) examined the role of cloud computing in the electronic systems of supply chain management. Organizational information processing theory has been utilized as a theoretical basis in this study. The study examined the degree to which task, environmental, and inter-organizational uncertainty influence cloud computing adoption. The hypothesized model has been examined with quantitative and qualitative approaches. The quantitative analysis results showed that there exists an important two-way association between every independent variable and the moderating variable. The qualitative results showed that information processing requirements and information processing capability have a significant impact on intention to adopt cloud computing.

Christauskas and Miseviciene (2012) investigated modern trends in accounting software for small to medium enterprises in Lithuania. The authors observed that cloud based accounting software is one of the newest methods in the information technologies world and SMEs can get a lot of advantages with the cloud based accounting software. The paper summarizes main characteristics of cloud computing advantages and risks. It was revealed in this study that Lithuanian companies preferred locally developed stand-alone accounting systems (71 %). Major barriers identified in this work included - critical approach to web technology innovation as well as a lack of information about the benefits of technology and security.

Garrison *et al.* (2012) observed that despite many benefits of cloud computing, organizations face obstacles while adopting cloud services such as- uncoordinated adoption by stakeholders, inadequate business and technical judgment, data security, insufficient understanding among the firm and the service provider about the extent, scope, and execution of the services. The authors have tried to empirically investigate the factors that are most likely to enable deployment of cloud computing in the organizations. The results reflected the importance of technological, executive, and interpersonal capabilities for leveraging cloud-computing resources to maximize the likelihood of deployment success and competitive advantage. It has been found in the study that faith, managerial competence, and practical ability have a significant association with cloud-deployment performance. Trust has been found to be a strong

predictor of deployment success and a key factor in effective collaboration and assurance that the client organization's cloud strategy is implemented in its best interests.

Geczy *et al.* (2012) have observed that cloud computing adoption has not yet picked up the momentum as was expected, due to some serious issues such as security and privacy of business data, perceived loss of control and insufficient regulations. All the major concerns surrounding cloud computing adoption are categorized into three types which include orientation, management control and legal. Alignment is basically associated with the compatibility of cloud computing with the existing IT infrastructure. Factors like security, management, relocation, control loss and data loss have been put under the dimension – management & control. The third dimension namely legal include liability, disclosure, and legislations. Principal benefits of cloud computing are also categorized under three dimensions which are- deployment, financial and functional. A cautious approach has been recommended for organizations willing to use cloud computing by carefully analyzing the advantages & disadvantages associated with it.

Hoberg *et al.* (2012) have synthesized the prevailing research on cloud computing with a business viewpoint by investigating 60 sources. Results of the study are structured according to the four dimensions -cloud computing features, adoption factors, governance mechanisms, and business effect. This research work revealed a shifting attention from technical facets to a larger understanding of cloud computing as an innovative IT delivery model. Growing consensus has been found about cloud computing characteristics and design principles. It is highlighted in this study that there is a dearth of research studies on factors enabling or inhibiting the adoption of cloud services. Due to the novelty of cloud computing concept, a limited research work is found on empirically assessing cloud computing's business impact.

Lin and Chen (2012) examined opinion and anxieties of IT professionals related to cloud computing adoption. DOI theory has been used to strengthen the identification of the factors encouraging & preventing its adoption. Compatibility, industry standards, service level agreements, and successful case studies are found to be important factors in cloud computing adoption. Further research has been recommended to identify issues faced by the organization while adopting cloud computing.

Tan and Lin (2012) assessed the level of cloud computing adoption amongst organizations in Singapore. The authors highlighted the impact of organizational issues, perceived features of

cloud computing, and environmental aspects on cloud computing adoption. TOE framework and DOI theory were used as a theoretical foundation. Findings of the work indicated that factors such as organizational technology readiness, relative advantage and perceived external pressure were positively related to the adoption of cloud computing.

Wang (2012) incorporated credibility trust as a new factor into the UTAUT model to reflect the consumer's security concerns in the adoption of SaaS and also examined the impact of original factors on SaaS adoption. This study has contributed to a more refined understanding of credibility trust for the SaaS acceptance. One of the hypotheses that credibility trust has a positive effect on the social influence of the SaaS use, is supported in this study.

Abdollahzadehgan *et al.* (2013) highlighted the major advantages and disadvantages of cloud computing. TOE framework was used as a theoretical base. The significant factors revealed in this study included support from the top management, size of the firm and technology readiness. It is suggested that the factors identified are more important and helpful for those SMEs which are planning to adopt cloud computing in the near future

Aleem and Sprott (2013) studied the appropriateness of the cloud computing for organizations. The study is based on a survey of 200 IT experts. The study examined the concerns of these IT professionals related to privacy and data security associated with the cloud computing adoption. The results of the survey indicated security, governance, and loss of control over cloud service availability as the top concerns for organizations.

Borgman *et al.* (2013) have theorized and empirically tested the link between the TOE framework and the decision of organizations to adopt cloud computing, as well as the moderating effect of IT governance structures and processes on these relationships. Increased relative advantage, more top management support, and a higher competition were found to be positively associated with adopting cloud computing.

Ercolani (2013) has proposed an integrated model for calculating the potential adoption index (PAI) to quantify the benefits and disadvantages of cloud computing adoption. The PAI, indicates the overall adoption utility level of a SaaS solution. PAI is based on the evaluation of features, benefits, and concerns from the business perspective and the technical fit from cloud experts' viewpoint.

Islam *et al.* (2013) utilized literature review to identify various limitations of cloud computing adoption. Prospective solutions towards the problem identified are also presented. The major problems identified consist of data confidentiality, safety, interoperability, vendor lock-in, availability, the absence of SLA, reliability, network problems, and lack of scalable storage. It is witnessed that cloud computing is extensively accepted by the SMEs for its small cost whereas, large enterprises have a tendency to rely on their own ICT resources rather than depending on cloud service provider.

Kaufmann *et al.* (2013) have proposed a metrics suite to measure adoption readiness and assess the required adjustments in strategy and management, technology and operations, and business policies at a firm level. Four categories identified in this study to measure the firm level adoption readiness include technological, economic, organizational and environmental factors.

Morgan and Conboy (2013) have utilized subjective evidence and focused on technical issues related to cloud computing adoption. The explorative design has been followed in this work. Four technological characteristics that are revealed in this study include- trialability, relative advantage, compatibility, and complexity. One organizational factor impacting customer adoption is the aspiration to advance partnerships and encourage openness both inside and outside of the organization. Security and legal issues are highlighted as the main environmental factor impacting cloud adoption. Further research that focuses on descriptive and conclusive research using an integrated research framework is recommended in this study.

Nkhoma and Dang (2013) developed and tested a theory-based conceptual model indicating factors of cloud computing adoption. TOE framework was used as the theoretical basis. All the drivers and barriers of cloud computing adoption were captured in the TOE framework. The main reason cited to select TOE framework was the ability of this framework to offer a holistic view on the numerous aspects of an organization rather than focusing on an individual's viewpoint as considered in the TAM. Secondary data (large scale survey conducted by IBM) was used to validate the model. The model explained only about 23.3 percent of the variance in intention to adopt cloud computing. Lack of statistical support provided to the drivers & barriers identified from theory and literature has been mainly attributed due to the data quality in this study. Only one hypothesis pertaining to adopter's style was supported by the data.

Park and Kim (2013) have explored factors that influence perceptions toward mobile cloud computing services. These factors are integrated into the technology acceptance model. A

structural equation modeling analysis is employed on data collected from 1099 survey samples. Analysis of the study reveals that user acceptance of mobile cloud services is mainly affected by perceived mobility, connectedness, security, quality of service and system, and satisfaction.

Walterbusch *et al.* (2013) have suggested a total cost of ownership (TCO) technique for cloud computing services. A systematic literature examination, inspection of actual cloud computing services, professional interviews, and case study method were employed by the authors for the development and valuation of a formal mathematical TCO model. It was established that decision procedures in cloud computing are carried out on a temporary basis which lack systematic methodology. The paper recommended a mathematical model for the calculation of the TCO of cloud computing services. This model is expected to help decision makers in deciding whether to adopt cloud computing or not, on the basis of cost involved in adopting cloud computing and cost involved in procuring ICT in a traditional way.

Alotaibi (2014) has developed an extended TAM, wherein trust, anxiety and perceived risk are integrated to investigate users' attitude and intention toward the adoption of cloud computing. The projected model is empirically examined using the structural equation modeling (SEM) to analyze data gathered by a survey of both IT professionals and end users. The results indicated that trust, anxiety and perceived risks can be successfully integrated within the TAM. The proposed model has been verified to be a true predictor of user intentions, towards the use of cloud computing, within the context of Saudi Arabia.

Gangwar *et al.* (2015) integrated TAM & TOE models to comprehend adoption of cloud computing at firm level. A conceptual framework is created and tested empirically with a sample size of 280 companies. The study highlighted comparative advantage, complexity, compatibility, top management support, organizational readiness, and training as the important variables affecting cloud computing adoption. The authors used perceived ease of use (PEOU) and perceived usefulness (PU) as mediating variables. Competitive pressure and trading partner support were also found to directly affect cloud computing adoption.

Lian *et al.* (2014) have investigated critical factors that affect decision to adopt cloud computing technology in Taiwan's hospital industry. This study integrated the TOE framework and HOT-fit (Human-Organization-Technology fit) model to comprehend the primary issues. Information was collected by employing a questionnaire based research design. CIOs employed in Taiwanese hospitals were mainly targeted for data collection. The results indicated

that data safety, perceived technological competence, cost advantage, top management support, and complexity were the significant factors in cloud computing adoption. Further, amongst the projected four dimensions technology was found as the most important followed by human, organizational, and environmental factors.

Oliveira *et al.* (2014) carried out a study to comprehend the determinants of cloud computing adoption and their relative advantage to organizations. For this, a research model based on TOE framework and DOI theory was formulated. Data from 369 Portuguese firms was used to empirically testing the framework and for hypotheses testing. The results showed that relative advantage, technological readiness, complexity, top management support, and firm size had a direct impact on a firm's adoption of cloud computing.

Stieninger *et al.* (2014) have carried out a study to hypothesize and operationalize factors influencing technology adoption in the cloud computing context. A literature review on technological innovation characteristics was conducted to identify potential gaps in ongoing research. The review provided a summary of pertinent empirical studies on cloud computing that are based on theories for innovation adoption such as DOI theory and the TAM model. The factors identified and examined in this study include-compatibility, relative advantage, complexity, image, security, and trust. These factors are further operationalized in reference to cloud computing.

Elena and Johnson (2015) have developed a theoretical framework to understand risk perception and risk acceptance of cloud computing services by UK Government sector. Analyzing the results from a sample of 24 respondents indicated that perceived benefits, perceived opportunities, risk culture in the organization, and risk perception were the most significant factors that influenced risk acceptance of cloud services.

Gutierrez *et al.* (2015) have explored factors influencing managers' decision to adopt cloud computing in the UK using TOE framework. The sample consisted of 257 respondents which mostly included mid to senior level professional from a wide range of companies in the UK. The study revealed that three key factors impacting cloud computing adoption intention include external pressure, complexity, and technology readiness.

Opala (2015) determined the impact of management's perception of security, cost-effectiveness and IT compliance factors on cloud computing adoption. The data analyzed using multiple linear regression analysis revealed that managements' perception of cost-effectiveness

was more significantly correlated to their decision to adopt cloud computing than security concerns.

Safari *et al.* (2015) have made an attempt to understand the adoption of SaaS among different organizations by ranking various determinants. The authors have used TOE framework and DOI theory for this purpose. Data from 30 IT professionals and application of fuzzy analytical hierarchical process reveal that ten factors representing technological, organizational and environmental contexts influence SaaS adoption in organizations and top three factors consist of relative advantage, top management support, security and privacy.

Sallehudin *et al.* (2015) suggested a theoretical model to define the factors that influenced adoption of cloud computing by public sector organizations in Malaysia. A sample of 85 respondents comprising the head of the department, CIO, IT Directors and IT managers working in public sectors companies in Malaysia is used in this study. DOI and personal characteristics are used as the theoretical foundation in the study. The results indicated that comparative benefit, compatibility, and IT employee's knowledge are the invention attributes and the human issues for cloud computing adoption in the Malaysian public sector.

Tripathi and Jigesh (2015) have used technology to performance chain (TPC) model to assess the performance influence of cloud technology in organizations. The sample of the study consisted of four multinational IT firms. It is revealed that all the surveyed firms supported the use of cloud computing to increase the effectiveness of individuals in performing their job tasks. Production timeliness, system reliability, ease of use, authorization to access data, automation, and training are found as positive factors that influence the individual performance through the use of cloud computing.

Yaw *et al.* (2015) have attempted to measure the ICT awareness of stakeholders in health care while also providing an evidence of the possibility of cloud implementation by Ghana Health Services in relation to the ICT awareness of stakeholders. A framework is provided for a cloud based e-health adoption by Ghana Health Services. It is pointed out in this study that cloud adoption fits very well with increasingly mobile healthcare professionals who may need to administer service from remote locations.

Yigitbasioglu (2015) has explored the role of institutional elements on the organization's decision to adopt cloud computing services. A model is established and verified with data from 120 Australian manufacturing and service organizations using the PLS modeling technique.

The study exposed that imitative and forced pressures effect top management's beliefs in the benefits of cloud computing. The results also show that top management's opinions initiate their contribution, which subsequently influence their intention to adopt cloud computing.

Zainuddin *et al.* (2015) reviewed cloud computing benefits and implementation aspects in hospitals. Cloud computing adoption factors were further identified and a conceptual model was proposed for understanding the adoption phenomenon by considering security perspective in the case of hospitals in Malaysia. The conceptual model proposed in this ongoing research was grounded on TOE framework. One additional dimension i.e. security was added to the conceptual framework.

El-Gazzar *et al.* (2016) employed Delphi technique involving 34 experts representing clients, providers and IT professionals to assess important factors that impact cloud computing adoption. It is revealed in this study that the most important issues concerning adoption of cloud computing by organizations include- security, strategy, legal and ethical.

Senyo *et al.* (2016) investigated cloud computing adoption among organizations from Ghana. Data collected from 305 organizations and analyzed by using CFA and logistic regression revealed that comparative advantage, top management backing, technology readiness, and external pressure influenced cloud computing adoption by organizations in Ghana.

The review of literature reveals that researchers have explored cloud computing adoption from different perspectives. Technical, managerial, operational and economic aspects of cloud computing have been examined in the above studies. Various theoretical models are utilized by the researchers to gain understating about the cloud computing adoption process. Different research methodologies and statistical techniques are employed for data analysis and hypotheses testing. The need for a more comprehensive, holistic and integrated framework based on one or more theories, which incorporates and considers all the relevant factors pertinent to the technology being investigated along with the context of the study, is found as a common recommendation for future research work related to cloud computing adoption among organizations. It has been further observed that a very few studies are carried out in an Indian context. A summary of some of the relevant studies on cloud computing adoption published in peer reviewed journal is presented in Table 2-3.

Table 2-3. Studies on cloud computing adoption published in peer reviewed journals

Sr. No.	Theoretical basis	Construct/Factors (independent variables)	Methods	Data and context	Author (s)
1.	TOE framework	Relative advantage, complexity, compatibility, top management support, firm size, technology readiness, competitive pressure, and trading partner pressure	Logistic regression analysis	111 high-tech firms from Taiwan	Low *et al.* (2011)
2.	DEMATEL approach	Perceived benefits, perceived risks	Case study based methodology	One Taiwanese firm	Wu *et al.* (2011)
3.	IT based capabilities, resource based theory	Managerial IT capabilities, Technical IT capabilities, relational IT capabilities, cloud success, firm performance	CFA and SEM	302 Korean firms	Garrison *et al.* (2012)
4.	TOE framework and HOT fit model	Top management support, security, cost benefits, technical competence, and complexity	Descriptive statistics, ANOVA	CIO of Taiwanese Hospitals	Lian *et al.* (2013)
5.	TAM Model	Perceived usefulness, perceived ease of use, external variables (trust, anxiety, perceived risk)	SEM	770 IT professionals and end users	Alotaibi (2014)
6.	TAM and TOE models	Relative advantage, compatibility, complexity, organizational readiness, top management commitment, training and education, perceived usefulness, perceived ease of use	CFA and SEM	280 Indian companies	Gangwar *et al.* (2015)
7.	TOE framework, DOI theory	Relative advantage, complexity, technological readiness, top management support, and firm size	CFA and SEM	369 firms from Portugal	Oliveira *et al.* (2014)
8.	TOE framework	Competitive pressure, complexity, technology readiness and trading partner pressure	Principal Component Analysis, Logistic regression	257 managers from the UK	Gutierrez *et al.* (2015)
9.	DOI theory	Relative advantage, complexity, compatibility, trialability, and IT personnel knowledge	SEM	85 professionals from Malaysian public sector firms	Sallehudin *et al.* (2015)
10.	Institutional theory	Institutional factors	Partial Least Square modeling technique	120 Australian firms	Yigitbasioglu (2015)

2.5 Cloud computing adoption in SMEs

The current study is concerned with examining the suitability of cloud computing for SMEs by identifying important factors influencing SMEs intention to adopt cloud computing. SMEs are very different from their larger counterparts in many ways. SMEs nature of operation, clientele, organizational structure, manpower requirements, and challenges faced are quite different from the large organizations. Further, some of the unique characteristics and facts about SMEs such as owner centric approach, informal organizational structure, and resource constraints are also responsible for the difference in the pattern and acceptance of ICT adoption among SMEs and large enterprises (Rahayu and Day, 2015; Taylor, 2015). These differences have a significant effect on the way innovation diffusion and adoption of ICT take place in SMEs. Therefore, in order to further explore cloud computing adoption by SMEs, it is necessary to review the related literature to get understating about the extent of research work carried out in this domain and also to identify the research gaps observed in the literature. A brief summary of various related studies is presented in this section.

Rath *et al.* (2012) explored the adoption of cloud computing by SMEs in India. A preliminary survey was used in the study to find out different situations for adopting cloud computing services. It was revealed that SMEs benefit more if they adopt cloud services for computation intensive jobs like data mining, optimization, risk modeling and simulation. The other finding of the study highlighted the advantages for SMEs such as lowered investment in hardware, more efficient use of computing systems in existing data centers, easier scale-up of the applications and services and cost saving on technology infrastructure and faster software upgrades without much expense. Lack of theoretical basis for this study and use of a limited number of variables are the two main shortcomings of this study.

Agostino *et al.* (2013) have identified key success factor for SME customers of cloud based business intelligence products. Interview and questionnaire methods were used to collect data. The important critical success factors revealed in the study included the level of software functionalities, the ubiquitous access to data, responsive answers to customer support requests, handling large amounts of data and implementation cost. Further research work is recommended to find out the evaluation criteria for such SMEs which are currently planning to adopt BI solutions through the cloud.

Alshamaila *et al.* (2013) examined cloud computing adoption by SMEs in England. TOE framework was applied as the theoretical basis for the study. 15 SMEs and cloud service providers were approached for data collection through interviewing method. The main factors playing a significant role in SME adoption of cloud services identified in this study included relative advantage, uncertainty, geo-restriction, compatibility, trialability, size, top management support, prior experience, innovativeness, industry, market scope, supplier efforts and external computing support. Small sample size and qualitative methods used for data collection limit generalizations of the findings. Regional differences in terms of skills and service provider's support are not considered in this study, which may significantly influence cloud computing adoption in SMEs. Careful selection of sample is recommended to better understand cloud computing adoption keeping in view the universal nature of SMEs globally.

Gupta *et al.* (2013) explored perceived inclination of SMEs toward cloud computing. It is observed in this study that SME's needs and business requirements are very different from large enterprises. Five factors were identified in this study which influenced the cloud usage by SMEs. A sample of 211 SMEs from Asia Pacific Region was used for data collection. SEM was used for data analysis. It was revealed that ease of use was the major favorable factor followed by security concern and cost benefit was the third important factor in cloud computing adoption. The fourth factor reliability was overlooked as SMEs did not find cloud as dependable. Only five core variables are used in this study which limits the predictive power of the research framework proposed in this study.

Makena (2013) explored factors that affect the adoption of cloud computing by SMEs in Kenya. The research findings have shown that technological, organizational and environmental factors have affected the adoption of cloud technologies. A total of 220 interviews with ICT officers and business owners were conducted. The major factors influencing adoption of cloud computing by Kenyan SMEs included top management support, size, technology readiness, relative advantage, competitiveness, complexity, and compatibility. Qualitative methodology used for data collection and use of descriptive analysis makes it difficult to assess the relative importance of various factors identified in this study.

Saedi *et al.* (2013) proposed an integrated theoretical model for cloud computing adoption in SMEs. TOE framework and Actor Network Theory (ANT) were used as a theoretical foundation in the proposed model. Case based methodology and literature survey were used in

this study to highlight the factors affecting cloud computing adoption. The proposed research model was not tested empirically.

Sahandi *et al.* (2013) explored the perception of cloud computing from an SME standpoint. A survey of 300 SMEs in the UK was carried out to show SME's motivations and concerns for adopting cloud computing services. Key driving factors revealed in the survey included- cost reduction, improved accessibility, flexibility, and scalability. Major concerns highlighted in this research work included security issues, vendor lock-in, complications with data privacy and data protection. This study is more like a conceptual work accompanied by a simple survey which attempts to capture SMEs viewpoint about cloud computing. The study lacks theoretical basis and empirical evidence concerning determinants of cloud computing adoption by SMEs.

Seethamraju (2013) attempted to explore the factors that influenced the adoption of SaaS based ERP system by SMEs. A cross-sectional research design was used which comprised data from four organizations and software vendors. Benefits, challenges, and determinants of cloud computing adoption are highlighted in this study. A small total cost of ownership, low preliminary investment costs, possible readiness of the vendor to participate in co-creation of value for customers, constant improvement of the product offerings and general benefits of implementing an integrated ERP system were identified as the major determinants of SaaS ERP adoption by SMEs. Vendor's reputation, lesser implementation time, total cost of ownership, constant product improvement efforts by vendor, vendor's customer support during the initial cloud deployment and usage phases, were the factors that enticed SMEs towards SaaS ERP systems. The scope of the study is confined to one category of SaaS application, which is ERP. The results, therefore, cannot be generalized for other SaaS based applications.

Avram (2014) attempted to analyze factors that need to be considered by an enterprise when making the decision of using cloud computing. It has been found that some of the companies are moving towards cloud computing just because it is the latest trend in information technology. On the other hand, other companies cannot even take into consideration the idea of having their sensitive data outside their premises. Both of these cases represent companies that are not very well informed about the latest technological developments in the area of ICT. It is recommended that before rushing into the cloud, the company should study their processes and evaluate the risks and advantages brought to their business. SMEs are indicated as the most suitable business customers of cloud computing because of the simplicity of processes in SMEs. This is only a conceptual and qualitative work and thus lacks empirical validation.

Prasad *et al.* (2014) have established and tested a framework for cloud computing adoption by the Australian SMEs. The study revealed that the factors that influence cloud computing adoption include the strategic intent of SMEs, ensuring adequate human resource capacity to introduce and manage cloud computing, and understanding the value potentials of cloud computing. The interpretive design was followed to enable formulation of a research model, which is yet to be validated.

Carcary *et al.* (2014) have examined findings from a recent exploratory study about the adoption of cloud computing by Irish SMEs. A sample consisting of 95 SMEs from Ireland was used in this study. It was observed that about 50 percent of the respondents had not migrated any services or processes to the cloud environment. Further, among those who have migrated some of the services into the cloud, the data reveals that many of these SMEs did not carefully evaluate their willingness for accepting cloud computing technology. A large gap has been reported in this study between the literature and the actual cloud computing adoption process followed by the SMEs. A small sample size used in this study prevents generalization of results.

Yeboah-Boateng and Essandoh (2014) have attempted to assess the factors which influence SMEs in a developing economy to adopt cloud computing. The main drivers highlighted in this study consist of cost saving on IT infrastructure and maintenance, better communication, scalability, and business continuity. The obstacles revealed in this study include- lack of information, bad internet connectivity, security concerns, lack of faith and interoperability with existing systems. Top management backing, trialability, the capability of cloud vendors, resistance to change, compatibility, and presence of IT infrastructure are reported as key factors influencing cloud computing adoption. However, this study lacks theoretical basis and use of descriptive analysis inhibits in drawing improved statistical inferences.

Abubakar *et al.* (2014) have explored the emergence and adoption of cloud computing by small and medium- sized enterprises (SMEs) in context to sub- Saharan African region. Top management support and cost are identified as the main contributors towards the adoption of cloud computing amongst SMEs. One important point highlighted in this study is that the SMEs in sub-Sahara African countries are less concerned about security, privacy & data loss. Lack of theoretical basis, use of a very limited number of variables and application of qualitative research are the main limitations of this research work.

Abdullah & Hassan (2015) have used secondary data to evaluate factors that affect the adoption of cloud computing by Iraq's SMEs. Cost reduction involved in IT infrastructure deployment and maintenance, improving communication, versatility and business coherence are revealed as the major drivers of cloud computing. The crucial elements which effect the adoption of cloud computing consist of top management support, the reputation of cloud vendors, resistance towards adopting a new technology, compatibility and presence of IT Infrastructure. Absence of primary data and use of judgmental conclusion are the major limitations of this study.

Ross & Blumenstein (2015) have inspected relevance of cloud computing technologies for SMEs sector. It is observed that cloud technologies can enable the development of internationally orientated SMEs entrepreneurship by providing greater access to global markets, lowering opportunity costs and supporting collaboration and innovation in a progressively connected world. It is also pointed out that cloud computing paradigm also brings associated threats for SMEs.

Trinh *et al.* (2015) have recognized the factors that influence adoption of SaaS by SMEs. An integrated model is derived from three technology adoption theories including DOI, TOE, and protection motivation theory (PMT). In addition to the three core factors of technology, organization and environment, one additional factor called security risk is also considered to assess the effects of cloud security risks, cloud provider' risk response measures and self-efficacy on the intention to adopt SaaS by the companies. The research framework proposed in this study seems very comprehensive however, it is not empirically validated. Further, the study considers only one form of cloud computing that is SaaS.

Prasad & Green (2015) have provided guidelines for SMEs about cloud computing adoption emphasizing on long term commitment and achieving sustainable value by utilizing cloud computing. TOE framework is used in this study to understand the key factors which SMEs should need to consider while opting for cloud computing. A sample of 186 Australian SMEs is used in this study to collect data. The significant factors influencing cloud computing service related objectives revealed in the study include- a strategic and incremental intent, understanding the organizational structure and culture, understanding the external factors, and consideration of human resource capacity. This study did not show a direct relationship between the factors influencing cloud computing adoption and cloud computing adoption intention. The study has focused on assessing the influence of technological, organizational,

environmental, and human factors on the sustainable business value which can be gained from adopting cloud computing.

Alismaili *et al.* (2016) in their research-in-progress have proposed an integrated framework for examining the determinants of cloud computing service adoption. The authors have given due consideration to the unique features of Australian SMEs which include less inventive, low awareness about cloud computing, low adoption rate amongst SMEs. Fourteen factors have been identified in this ongoing research which are taken from theories like TOE framework, Diffusion of Innovation and Actor Network Theory. The proposed research framework is yet to be tested empirically.

Al-Isma'ili *et al.* (2016) have developed and empirically verified a research model founded on the diffusion of innovation theory and TOE framework, to examine the factors that influence the adoption of cloud computing by Australian SMEs. Data from 203 firms are utilized to examine the associated hypotheses. Data analysis using partial least squares indicates that technological factors, organizational factors, and environmental factors influence cloud computing adoption decisions by SMEs. The results of data analysis show that the combination of all these variables explains only 21 percent of the variance of the current adoption stage of cloud computing in SMEs, which calls for including some additional new variables in the proposed model.

Priyadarshinee *et al.* (2016) have carried out a comprehensive review of literature in order to explore the existing key issues related to cloud computing adoption among small medium enterprises (SMEs). 55 research articles published about cloud computing adoption in SMEs are reviewed in this work. All articles are classified into four main categories: cloud computing; adoption of cloud computing; adoption of cloud computing in SMEs; risk analysis in cloud computing adoption by SMEs. This review study has focused more on those aspects which are related to risk analysis in the adoption of cloud computing in SMEs. The authors have observed from the literature review that enterprises face serious problems after implementation of cloud computing which in turn exposes SMEs to various kinds of risks. The authors recommend more theoretical, methodological, and empirical research contributions in the area of cloud computing adoption among SMEs.

Khan and Al-Yasiri (2016) have revealed by following a qualitative research methodology that concerns like cloud knowledge, interoperability, security and contractual concerns hinder

SMEs adoption of cloud services. A set of guidelines is proposed for SMEs to manage challenges faced while adopting cloud computing. A detailed framework comprising cloud preparation, requirement and migration stages is developed by the authors for SMEs. A different approach is followed by the authors which focuses more on cloud implementation process. The proposed framework still requires to be verified empirically.

A summary of some of the relevant studies on cloud computing adoption by SMEs is presented in Table 2-4.

Table 2-4. Studies on cloud computing adoption among SMEs

Sr. No.	Theoretical basis	Construct/Factors (independent variables)	Methods	Data and context	Author (s)
1.	TOE framework	Relative advantage, uncertainty, geo-restriction, compatibility, trialability, size, top management support, prior experience, innovativeness, industry, market scope, supplier efforts and external computing support	Explorative study, semi structured interviews, qualitative analysis	15 SMEs from north east of England	Alshamaila *et al.* (2013)
2.	-	Enablers: cost reduction, improved accessibility, flexibility, and scalability; Inhibitors: security issues, vendor lock-in, complications with data privacy and data protection	Survey based, descriptive statistics	300 SMEs from the UK	Sahandi *et al.* (2013)
3.	-	Cost reduction, ease of use and convenience, reliability, sharing and collaboration, security and privacy	SEM	211 SMEs from Asia Pacific region	Gupta *et al.* (2013)
4.	-	Organization perspective, process perspective, technology perspective; Performance, integration, flexibility, reliability, support, cost of ownership	Semi structured interviews and questionnaire	36 SMEs	Agostino *et al.* (2013)
5.	TOE framework	Top management support, size, technology readiness, relative advantage, competitiveness, complexity, and compatibility	Qualitative & descriptive analysis	220 ICT officers from Kenya	Makena (2013)

6.	-	Cost of ownership, initial investment costs, readiness of the vendor to contribute in co-creation of value for customers, constant enhancement of the product offerings and general benefits of employing an integrated ERP system	Qualitative analysis	Four case study organizations (SMEs and Vendors)	Seethamra (2013)
7.		Steps in preparation of cloud adoption; reasons for non-adoption; cloud adoption benefits	Explorative study, Descriptive statistics	95 Irish SMEs	Carcary *et al.* (2014)
8.	TOE framework	Technological factors, organizational factors, environmental factors	Relative importance index	ICT based SMEs from Ghana	Yeboah-Boateng and Essandoh (2014)
9.	-	Top management support, cost benefits, security and privacy, data loss	Qualitative research	SMEs from sub-Sahara African Region	Abubakar *et al.* (2014)
10.	-	Top management support, fitness of cloud vendors, resistance towards adopting a new technology, compatibility, and presence of IT Infrastructure	Qualitative research	Secondary data about Iraq's SMEs	Abdullah & Hassan (2015)
11.	TOE, DOI, PMT (Protection Motivation Theory)	Technology, organization, environment, and security risk factors	Conceptual study	Model not empirically tested	Trinh *et al.* (2015)
12.	TOE framework	Strategic and incremental intent, organizational structure and culture, human resource capacity, external factors,	Descriptive statistics, SEM	186 Australian SMEs	Prasad & Green (2015)
13.	TOE framework	Technological factors, organizational factors, and environmental factors	Partial least square	203 Australian SMEs	Al-Isma'ili, (2016)
14.	-	Inhibitors-cloud knowledge, interoperability, security and contractual concerns; Guidelines provided for migration process	Qualitative research	Not tested empirically	Khan and Al-Yasiri (2016)

It is observed from the literature review that various authors have attempted to assess the acceptance and usage of cloud computing by organizations (Senyo *et al.,* 2016; Gangwar *et al.,* 2015; Gutierrez *et al.,* 2015; Yigitbasioglu, 2015; Oliveira *et al.*, 2014; Low *et al.,* 2011). For this, these authors have employed different theoretical models, factors, and data analysis techniques to better understand the adoption of cloud computing at the firm level.

However, a limited number of studies are found on cloud computing adoption by SMEs. TOE framework and DOI theory are used most frequently in the research on cloud computing adoption by SMEs (Alshamaila *et al.,* 2013; Gupta *et al.,* 2013; Makena, 2013; Carcary *et al.,* 2014; Yeboah-Boateng and Essandoh, 2014; Abubakar *et al.,* 2014; Abdullah & Hassan , 2015; Prasad & Green, 2015; Al-Isma'ili *et al.,* 2016). Review of literature further reveals that cloud computing adoption is explored by different authors by considering technological, organizational, and environmental perspectives along with the characteristics of innovation. Few studies are found where TAM is also used to predict cloud computing adoption by organizations (Gangwar *et al.,* 2015; Bhardwaj and Lal, 2012). Within the innovation characteristics, relative advantage, compatibility, and security concern are found as the major determinants of cloud computing adoption by SMEs (Alshamaila *et al.,* 2013; Makena, 2013; Al-Isma'ili *et al.,* 2016). The relative advantage of cloud computing for SMEs is described in the form of cost advantage, easy deployment and maintenance, improved scalability and business continuity (Alshamaila *et al.,* 2013). Empirical evidence in the literature suggests relative advantage as a significant factor in cloud computing adoption by SMEs (Alshamaila *et al.,* 2013; Makena, 2013; Senyo *et al.,* 2016). In the technology context, technology readiness is used as the major construct (Oliveira *et al.,* 2014). Organizational aspects in the form of top management support and firm size are also mentioned as important factors which influence cloud computing adoption by SMEs (Abdullah & Hassan, 2015; Abubakar *et al.,* 2014; Alshamaila *et al.,* 2013). Top management support is found as a crucial factor that positively impacts cloud computing adoption decisions among SMEs (Al-Isma'ili *et al.,* 2016; Oliveira *et al.,* 2014; Gangwar *et al.,* 2015; Wang *et al.,* 2010; Ifinedo, 2011). Environmental factors such as – external pressure and service providers' support also find mention in the literature (Abdullah & Hassan, 2015; Alshamaila *et al.,* 2013). It is observed that due to the novelty and some element of uncertainty associated with cloud computing, service provider's support assumes an important role in successful adoption and usage of cloud computing by SMEs (Alshamaila *et al.,* 2013). Service provider's support is found significant factors in many studies on cloud computing and other information technology adoption by SMEs (Al-Asmaili

et al., 2016; Gangwar *et al.*, 2015; Ramdani *et al.*, 2009). TAM model which is generally used to assess adoption of technology at an individual level, is also used in some studies (Gangwar *et al.*, 2015; Gupta *et al.*, 2013; Bhardwaj and Lal, 2012). Two constructs of TAM- perceived usefulness and perceived ease of use are considered as major determinants influencing individual's intention to adopt a given technology (Davis, 1986). Perceived usefulness and perceived ease of use are reported as major constructs explaining cloud computing adoption by organizations in two studies (Gangwar *et al.*, 2015; Bhardwaj and Lal, 2012).

2.6 Research gaps

It is apparent from the literature review that cloud computing has immense potential to increase ICT acceptance and adoption among SMEs, however, the rate of adoption of cloud computing among SMEs is quite low globally. Many studies are reported on cloud computing which have focused on various aspects such as economic, technical, operational and management. However, a limited number of research studies exist on cloud computing adoption by SMEs, especially in an Indian context. This is the main motivation behind the present research work. Additionally, it has been observed that most of the researchers in this area are recommending for using a more comprehensive and holistic research model which incorporates all the relevant factors pertaining to cloud computing adoption by SMEs (Olveira et al., 2014; Gangwar et al., 2015; Wu *et al.*, 2013; Gupta et al., 2013; Oliveira and Martin, 2011). Integrating two or more existing theories on information systems adoption is further recommended in the literature in order to enhance understanding about cloud computing adoption among SMEs. The dearth of such studies which are founded on strong theoretical base and which are empirically verified using sophisticated statistical techniques has been noticed in the literature review. An attempt is made in this research work to fill these research gaps.

Thus, based on the literature review and the gaps identified, the primary objective of this research study is to develop an integrated conceptual framework of cloud computing adoption in small and medium-sized enterprises (SMEs) in India covering the SMEs mainly from three northern states- Himachal Pradesh, Punjab, and Haryana, further sub-objectives are stated as:

- To identify and study the factors that influence adoption of cloud computing by organizations from extant literature.
- To develop an integrated conceptual framework based on the analysis of existing theoretical models, determining cloud computing adoption in SMEs in India.
- To empirically validate the developed conceptual framework.

CHAPTER 3
RESEARCH METHODOLOGY

3.1 Introduction

A suitable research strategy and methodology are required to be developed and followed for the systematic and successful conduct of a research study. This chapter provides the description of research strategy and research methodology adopted to address the research aims and objectives.

Considering very limited research on cloud computing adoption by SMEs, especially in an Indian context, an explorative study is considered as most reasonable (Zikmund *et al.*, 2010). A positivist research approach is believed suitable, keeping in view, the aim of this study, which is to make a contribution towards growing body of knowledge on the adoption of novel information technology like cloud computing in organizations by formulating and quantitatively testing a conceptual framework (Cohen *et al.,* 2011). In the research on the diffusion and adoption of innovation, quantitative approaches which are founded on questionnaire based survey, are the most prevalent research methodologies (Wang *et al.*, 2011). Therefore, a quantitative, cross sectional, and questionnaire based survey methodology was employed in this study.

The objective of this research is to assess the determinants of cloud computing adoption among SMEs in India. Based on the research objectives, research questions, and literature review, a conceptual framework was developed, followed by formulation of research hypotheses. A questionnaire based survey was then carried out for verifying the research model and to test the research hypotheses. A flow chart depicting various stages in research methodology followed in the present study is shown in Figure 3.1.

The structure of this chapter is as follows. Section 3.2 explains the process of developing the conceptual research framework. Hypotheses formulation is explained in section 3.3. Section 3.4 describes the procedure used to design the instrument for data collection. Data collection methodology followed is explained in section 3.5. Section 3.6 explains the reliability and validation procedure used to test the instrument. Data analysis strategy followed in this research work is described in section 3.7.

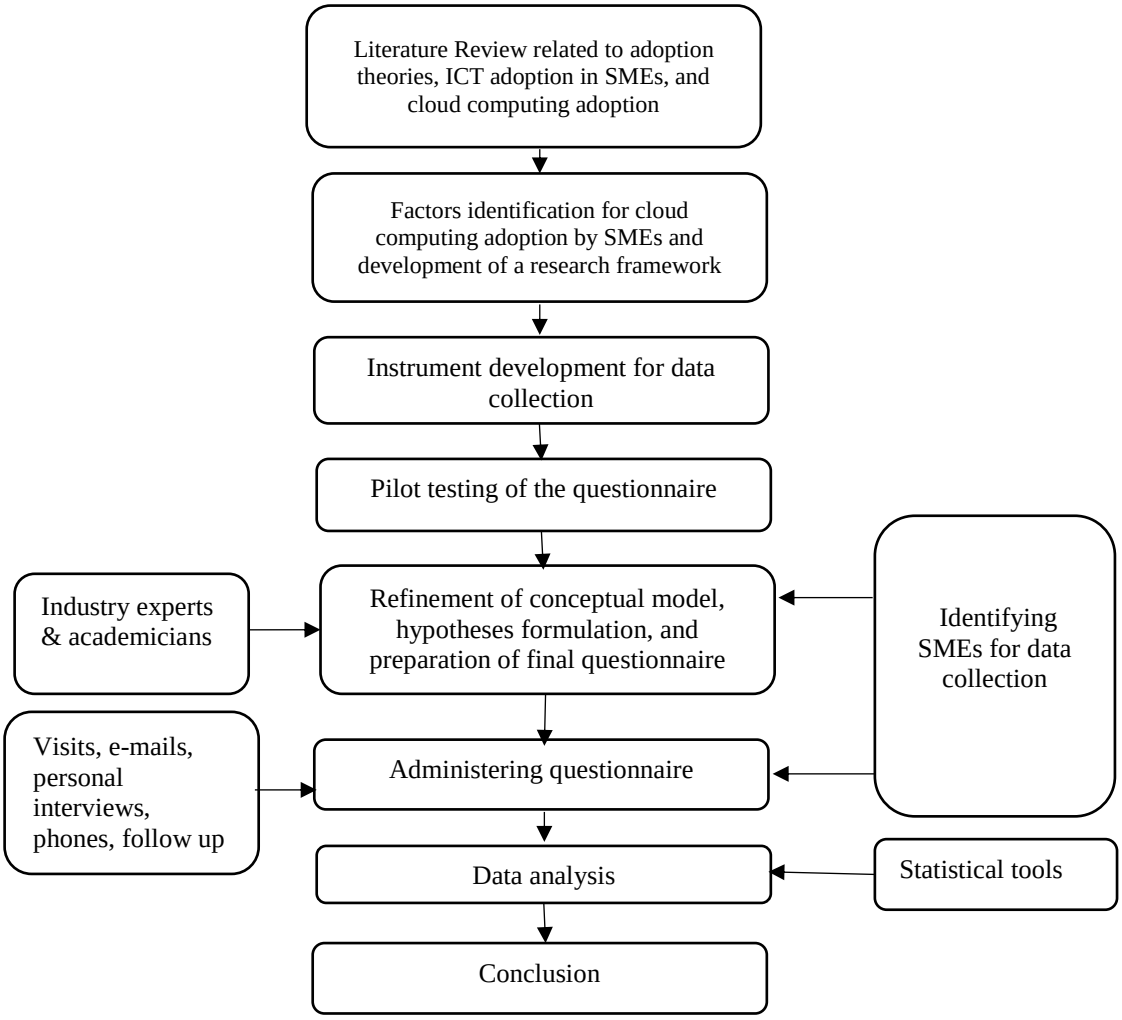

Figure 3.1 *Research methodology*

3.2 Development of research framework

Relevant theories concerning information system adoption and review of literature carried out in the previous stage were utilized for formulating an initial research framework. Three theoretical models were found appropriate for the current study that included – TAM, DOI, and TOE framework. The final research model was arrived at by identifying ten relevant factors and incorporating all these into an integrated framework combining TAM, DOI, and TOE. These ten factors were considered as the independent variables which included – perceived usefulness, perceived ease of use, relative advantage, compatibility, security and privacy, technology readiness, top management support, firm size, external pressure, and service providers' support.

The dependent variable used in this study was termed as cloud computing adoption intention. Here, cloud computing adoption intention refers to the SME's intention to adopt cloud computing and this variable is measured using three forward-looking statements that capture the intent of SMEs. A direct relationship between independent and dependent variables was considered following the suggestion by Rogers (2003) for the easy testing of the resultant model using multivariate techniques. The present study seeks to identify factors that drive SME's adoption intention towards cloud computing. Though intention does not necessarily lead to adoption, but it is highly related to adoption and it is possibly the finest available measure for such technologies which are in the earlier stages of their life cycle (Morrison, 1979; Teo et al., 1995). Adoption intention is used as a dependent variables in many other similar studies (Tsai et al., 2010; Tan et al., 2010; Chen and Lin, 2012, Gangwar et al., 2015).The definition and summary of the constructs used in the study are presented in Table 3-1.

3.2.1 Justification for combining TAM, DOI and TOE framework

It is recommended by many researchers that more than one theoretical models should be combined in order to have a clear and enhanced understanding about adoption process of innovative and new ICTs in organizations (Oliveira and Martins, 2011; Oliveira *et al.*, 2014; Wu *et al.*, 2013). The constructs or variables should be selected on the basis of the extensiveness of the situation and on the particularity of the innovation (Oliveira and Martins, 2011). The innovation in the present context is cloud computing. An idea, process or product is termed as an innovation when it is very new to the adopter (Rogers, 2003). When an organization adopts cloud computing, it accesses ICT resources through the internet instead of buying and deploying ICT on its premise. This brings many changes in the way organizations procure, implement, access, and maintain ICT. Therefore cloud computing is referred to as innovation in this study. Cloud computing is a new ICT delivery model that is yet to be adopted widely by the SMEs, especially in an Indian context.

TAM, TOE, and DOI enjoy extensive empirical support. TOE framework and innovation characteristics provided by Rogers in DOI are similar in many ways. Technology and organization perspectives of TOE framework match with some of the characteristics of innovation given in DOI theory. TOE framework makes an extension to DOI model by adding environmental context. Many researchers have used the combination of TOE and DOI to explain cloud computing adoption at the firm level (Safari *et al.,* 2015; Oliveira *et al.,* 2014; Low *et al.,* 2011).

Table 3-1. Definition of constructs

Sr. No.	Construct	Definition	Source
1.	Perceived usefulness	"the degree to which a person believes that using a particular system would enhance his or her job performance"	Davis (1986)
2.	Perceived ease of use	"the degree to which a person believes that using a particular system would be free of effort"	Davis (1986)
3.	Relative advantage	"the degree to which an invention is superior over its previous generation"	Roger (2003)
4.	Compatibility	"the degree to which the innovation is perceived as consistent with potential adopter's existing values, past experiences, and current needs"	Roger (2003)
5.	Security and privacy	Security refers to the safety of user's data/information. Privacy is concerned with clear definition and protection of user's rights to their data	Smith (2009)
6.	Top Management Support	Top management's involvement, motivation, and commitment towards the adoption of information systems.	Infinedo (2011)
7.	Technology readiness	Technological readiness is concerned with the technological infrastructure and IT human resources available within an organization	Tornatzky and Fleisher, 1990
8.	Firm size	The size of the firm in terms of number of employees and annual turnover	Rogers, 2003; Tornatzky and Fleisher, 1990
9.	External pressure	External pressure refers to the influences that an organization receives from sources external to it	Hart and Saunders (1997)
10.	Service provider's support	The supplier activities that can significantly influence the probability that an innovation will be adopted	Frambach *et al.*, (1997).
11.	Cloud computing adoption intention (Dependent variable)	SME's intention to use cloud computing. "Intention is significantly related to adoption and it is possibly the best available measure for such technologies which are in the earlier stages of their life cycle".	Morrison, 1979; Teo *et al.*, 1995

However, individual perspective is also important in SME's context. SMEs are mainly driven by their owners/business partners and these people are involved in all sort of decision making related to business. Owner centric feature of SMEs is also highlighted in a study on SMEs by Taylor (2015). Therefore, owner's intention and attitude may also play an important role in cloud computing adoption by the SMEs. This fact is also emphasized in other studies (Shah Alam *et al.,* 2011; Thong, 1999; Fichman and Kemerer, 1997). Individual's attitude towards adopting new system is driven by two variables namely perceived usefulness and perceived ease of use. This justifies the inclusion of PU and PEOU in the proposed framework. Limited studies are found that have used this combination of TAM and TOE to investigate IT adoption (Shah Alam *et al.,* 2011; Bhardwaj and Lal, 2012; Gangwar and Date, 2016). An integrated model based on TAM, DOI, and TOE to explain the adoption of ICT at an organizational level, does not find mention in the literature.

Owing to these observations and considering the context of the study and the technology being examined, this study makes an attempt to integrate three technology adoption models- TAM, DOI, and TOE, in order to have a clearer and better understanding about the adoption of cloud computing in SMEs. The resulting research framework is shown in Figure 3.2. TAM constructs are used to predict SME owner's intention and attitude towards adopting cloud computing. These constructs include PU and PEOU. Two characteristics of innovation provided in DOI are found relevant in cloud computing adoption by SMEs. These are – relative advantage and compatibility. Rogers (2003) has emphasized that relative advantage should be perceived in terms of economic profitability. Therefore, the cost benefits and operational advantages of cloud computing are included in relative advantage. The construct - compatibility determines compatibility of cloud computing with business, culture and existing IT infrastructure available in the SMEs. Due to special nature of this new innovation i.e. cloud computing which is founded on the concepts of virtualization and resource sharing, certain concerns regarding security and privacy of client's data are raised. These concerns, if not tackled and addressed properly, might adversely affect the adoption of cloud computing by organizations. Therefore, security and privacy are included in the innovation characteristics along-with relative advantage and compatibility. Technology context from the TOE framework is used to check the technology readiness of the SME for adopting cloud computing. Organizational context investigates the role of top management and firm size in cloud adoption decisions. Environmental context describes the extent to which cloud computing adoption

decisions are going to be influenced by external pressure and support provided by service providers.

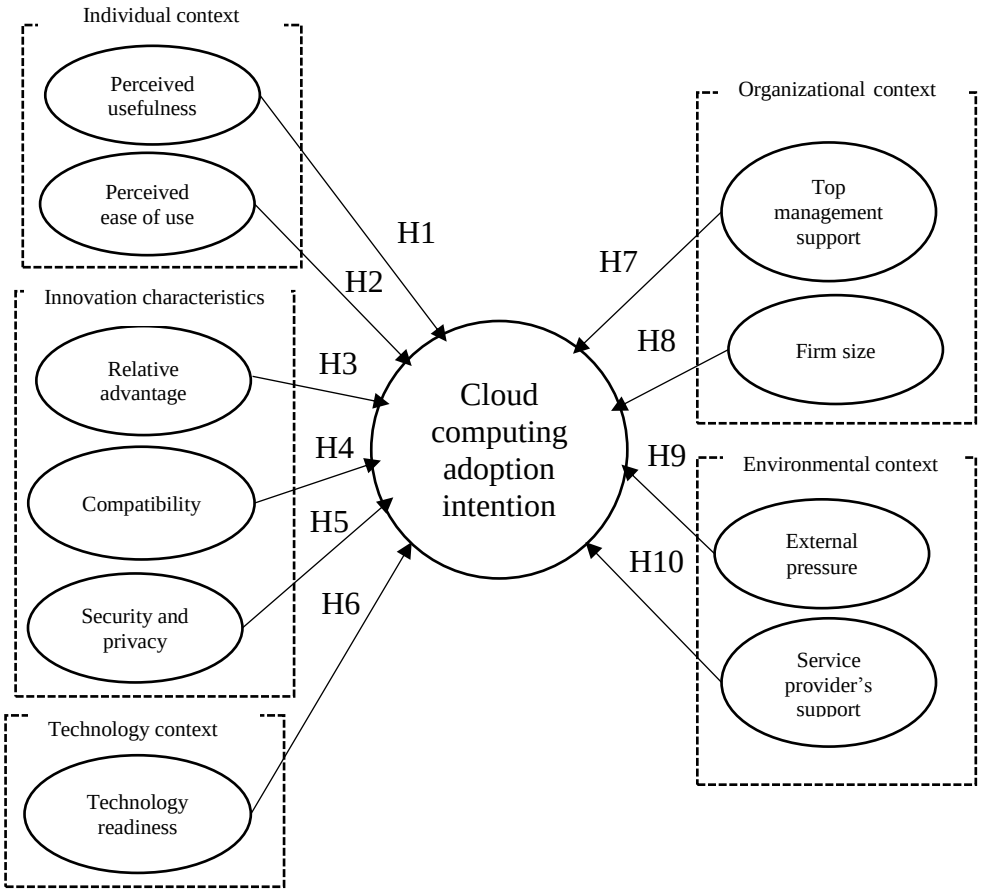

Figure 3.2 Research framework

3.3 Hypotheses formulation

Ten factors were found relevant for predicting cloud computing adoption intention by the SMEs in the present context. The process of hypothesis formulation followed in the study concerning the factors identified is presented in this section.

3.3.1 Perceived usefulness

Perceived usefulness refers to "prospective user's subjective probability that using a specific application will increase job related productivity, performance, effectiveness and/or profitability within organizational context" (Davis, 1986). It is one of the main determinants of IT adoption which provides insight into how user attitude towards using and intentions to use are influenced. One of the key objective of TAM has been to outline the impact of external variables on internal beliefs, attitude and intentions and, among these perceived usefulness and perceived ease of use are the most important factors in explaining system use (Legris *et al.*,

2003). Perceived usefulness and perceived ease of use have been found to be the primary determinants of IT/IS adoption in an organization. In the present context, perceived usefulness specifies the degree to which users perceive that using cloud computing will increase job productivity, performance & effectiveness. Using cloud computing helps in reducing the product development cycle time by reducing or eliminating information latency and greater efficiencies are achieved by using cloud computing in various applications (Goodburn and Hill, 2010). Perceived usefulness is also used as an important factor in other similar studies (Gangwar *et al.*, 2015; Bhardwaj and Lal, 2012). So, following hypothesis is proposed:

H1. Perceived usefulness positively influences SME's intention to adopt cloud computing

3.3.2 Perceived ease of use

Assessing end user's efforts required in using a particular information system is measured by a construct named perceived ease of use (Davis, 1986). Perceived ease of use is related to perceived usefulness but is considered as a separate factor which influences adoption of information system by the concerned individual (Awa *et al.* 2010). The likelihood of adoption of an information system will increase if user finds it easy to use and less complex (Shah Alam *et al.*, 2011). In the present context perceived ease of use is the degree to which users consider that using cloud computing is easy to access, learn and utilize. If manager/owner of SME finds cloud computing easy to use and less complicated, then the chances of cloud computing adoption will increase in that SME. Perceived ease of use is used as a determinant of cloud computing adoption in other similar studies (Gangwar *et al.*, 2015; Gupta *et al.*, 2013; Bhardwaj and Lal, 2012). The second hypothesis follows from this discussion:

H2. Perceived ease of use positively influences SME's intention to adopt cloud computing.

3.3.3 Relative advantage

Added and comparative advantages of a technology over its other substitutes play an important role in its adoption in organizations. Rogers (2003) described relative advantage as "the degree to which an invention is superior over its previous generation". In the current perspective the invention is cloud computing and its predecessor is the on-premise model of obtaining and consuming ICT resources. Cloud computing offers many unique benefits to organizations which no other computing model can provide. Relative advantage of cloud computing is manifested in the form of flexible payment option based on usage, enhanced scalability and

simpler installation & upgrade process (Geczy *et al.,* 2012, Goodburn and Hill 2011). Cloud computing allows SMEs to eliminate license and extra hardware cost along with maintenance costs associated with classical software deployment model and also empower SMEs to access the application form anywhere (Bajenaru 2010). Technical complexities related to ICT infrastructure set-up, operations and maintenance are taken care by the cloud computing provider in cloud computing environment. This feature of cloud computing frees the SMEs from hiring costly manpower to deploy and maintain ICT infrastructure. SMEs can thus focus on their core business (Goodburn and Hill, 2010). Through cloud computing, customers are able to increase or decrease computing capacity as per their requirements, resulting in significant improvement in their business performance (Smith, 2009; Ryan and Loeffler, 2010). Cloud Computing makes it easier for organizations to introduce business continuity and disaster recovery capabilities, by using cloud resources for redundancy (DeFlice, 2010). Several other studies have also used relative advantage as an important factor influencing cloud computing adoption (Ghobakhloo *et al.,* 2011; Low *et al.,* 2011; Alshamaila *et al.,* 2013; Oliveira *et al.,* 2014; Senyo *et al.,* 2016). Following hypothesis is formulated on the basis of this discussion:

*H3***.** Relative advantage of cloud computing positively influences intention to adopt cloud computing by SMEs.

3.3.4 Compatibility

Compatibility refers to "the degree to which the innovation is perceived as consistent with potential adopter's existing values, past experiences and current needs" (Rogers, 2003). Adoption decision of cloud computing are influenced by the business capability and cloud computing's compatibility with the existing systems in the organization (Oliveira *et al.,* 2014). Close alignment of existing systems and procedures of an organization with the cloud computing leads to more benefits from adopting cloud computing and reduces uncertainties associated with cloud computing (Gangwar *et al.,* 2015). In cloud computing environment, SMEs are expected to have sufficient systems and proper internet connection along with familiarity to work on internet-based interfaces (Safari *et al.,* 2015). The presence of such systems will make cloud computing compatible with existing systems which will result in increased chances of its adoption in the SME. In addition to the minimum basic ICT infrastructure required for using cloud computing, the organization's existing formats, data structures, and interfaces should also be compatible with cloud computing. The absence of

such compatibility may require more support from service providers for further integration and customization (Geczy *et al.,* 2012). Compatibility is reported as an important determinant of cloud based services adoption in a number of related studies (Oliveira *et al.,* 2014; Gangwar *et al.,* 2015; Safari *et al.,* 2015). Therefore, following hypothesis is proposed:

H4. Compatibility positively influences intention to adopt cloud computing by SMEs.

3.3.5 Security and privacy

Security is concerned with safety of user's data/information (Smith 2009). Security in cloud computing environment is not only about legitimacy, authorization and liability but is also linked with data safety, disaster recovery and business continuity (Katzan 2010). Many firms are unwilling to migrate their internal data onto the computers and servers which are external to their own company and which might be co-hosted with other company's applications (Smith 2009). According to a survey conducted by CIO Research Centre (2010), security continues to be the biggest concern when looking at cloud computing adoption. In cloud computing environment, the computing, storage and networking infrastructure of service provider is shared by many customers which raise serious security concerns (Shen and Tong, 2010; Subashini and Kavitha, 2011). The service provider is going to have access to the user's business data which may further increase the chances of security breach (Stine *et al.,* 2008). Identity management is another related challenge in cloud computing environment (Oliveira *et al.,* 2014). The absence of strong security mechanism, policies and legal framework may hamper cloud computing acceptance by organizations. Security and privacy aspect is also stated as one of the major characteristic of cloud computing in other similar studies (Oliveira *et al.,* 2014; Alismaili *et al.,* 2015). Security and privacy concerns are reported as major challenge in many studies on cloud computing (Al-Isma'ili *et al.,* 2016; Safari *et al.,* 2015; Oliveira *et al.,* 2014). Following hypothesis is therefore proposed:

H5. Security and privacy concerns negatively influence SME's intention to adopt cloud computing.

3.3.6 Technology readiness

Technological readiness is concerned with the technical infrastructure and skilled manpower available within an organization. For cloud computing, the required technological infrastructure includes servers, computers, networking technologies, information systems and

specialized human resources. The skilled manpower comprise of those employees who have the essential knowledge to implement and use cloud computing (Oliveira *et al.,* 2014). The level of knowledge about technological innovations positively affects the likelihood of their adoption by the organizations (Ifinedo, 2011). Existence of basic ICT infrastructure along with the technical skills, are crucial for effective acceptance of cloud computing in organizations. (Low *et al.,* 2010). So the firms having this technological readiness are more prepared towards cloud computing adoption. Therefore, following hypothesis is proposed:

H6. Technology readiness positively influences SME's intention to adopt cloud computing.

3.3.7 Top management support

Many organizational characteristics influence the adoption of new technologies in the organization which include – organizational structure, level of centralization, lateral communication, firm size, and top management support (Tornatzky and Fliecher, 1990; Low *et al.,* 2011; Oliviera *et al.,* 2014). Top management support is recognized as an important factor in IT adoption literature. Infinedo (2011) describes top management support as the management's involvement, motivation and commitment towards adoption of information systems. Top management support and commitment confirms adequate supply of resources required for implementing a new technology and helps in building a congenial organizational environment for adopting that technology by employees (Pan and Jung, 2008; Wang *et al.,* 2010). In Indian SME's context, where generally a simple and flat organizational structure is followed, top management refers to the owner of the SME unit. Owner of the SME unit is the head of all the functions and is the final decision maker. Therefore, if owner of the SME perceives cloud computing beneficial for the firm and easy to implement then it is more likely to be adopted. So, the following hypothesis is proposed:

H7. Top management support positively influences SME's intention to adopt cloud computing.

3.3.8 Firm size

Size of the firm plays an important role in influencing firm's intention to adopt technology (Rogers, 2003; Tornatzky and Fleisher, 1990). Firm size has been used as an important determinant in various studies on ICT adoption (Jeyaraj *et al.,* 2006). Large firms have more resources, greater economy of scale and have more risk taking capacity associated with technology adoption (Zhu *et al.,* 2006). Small firms on the other hand do not readily adopt new

technologies mainly because of resource constraints. Small firms even though are considered more agile, flexible and innovative, do not adopt new technologies easily (Lippert & Govindarajulu, 2006). In the present context, there are three types of enterprises namely micro, small and medium which are categorized on the basis of number of employees, annual turnover, and investment made in plant and machinery. Therefore, the larger firms within SMEs are more likely to adopt cloud computing than the smaller firms. Hence, following hypothesis is proposed:

H8. Firm size positively influences SME's intention to adopt cloud computing

3.3.9 External pressure

External pressure denotes impacts that an organization obtains from sources external to it. There are three sources of external pressure which are mentioned in literature and these include competitive pressure, supplier's pressure and customer's pressure (Hart and Saunders, 1997; Chau and Jim, 2002; Kula and Tatoglu, 2003; Chong *et al.,* 2009). Competitive pressure has great influence on adoption of new ICTs in the organizations and this fact is reported and confirmed in many studies (Hart and Saunders, 1998; Jeyaraj *et al.,* 2006; Huang *et al.,* 2008). Some innovations such as cloud computing helps in improving coordination and collaboration with business partners through enhanced and better networking, communication and business transactions. Thus, business partners or suppliers who are using new ICTs may press the organization to adopt the same ICTs. Business partner's influence in adopting new technologies is found as a significant factor in several studies (Hart and Saunders, 1998; Chau and Jim 2002; Mehrtens *et al.* 2001). Pressure from clients' side also influences SMEs intention to adopt new ICTs (Kula and Tatoglu, 2003). Further, the adoption of a new technology in an organization is significantly influenced by external pressure particularly when this technology directly affects the competition and is a strategic necessity (Oliveira *et al.,* 2014). These observation are equally applicable in cloud computing context. So, the following hypothesis is proposed:

H9. External pressure positively influences the intention to adopt cloud computing by SMEs

3.3.10 Service providers' support

Various marketing activities carried out by the service providers have a significant impact on SME's intention to adopt innovation (Alshmaila *et al.,* 2013). In cloud computing environment, the firms will get computing resources as a service from the service providers, on demand and

on pay-per-usage basis. The firms thus have to rely on the service providers for all those services which are migrated to the cloud. Therefore, cloud service provider's reputation, reliability and support become very crucial for uninterrupted and secure availability of cloud services. Various concerns raised in using cloud computing such as security, privacy, availability, and vendor lock-in further necessitates active participation and support by cloud service providers to address these issues and win client's confidence. Therefore, in cloud computing environment, the support from cloud provider's side assumes more important role in positively influencing the intention to adopt cloud computing by the SMEs. Service provider's support is also recognized as an important factor in cloud computing adoption by firms in other similar studies (Al-Asmaili *et al.,* 2016; Gangwar *et al.,* 2015). So, the following hypothesis is proposed:

H10. Service providers support positively influences SME's intention to adopt cloud computing.

3.4 Instrument development

A survey based on questionnaire was conducted for data collection. Objectives of the study, relevant theoretical models, and review of related literature were mainly used to design the questionnaire. The questionnaire comprised of three parts: organizational profile, adoption variables and personal detail of the respondent. Structure of the questionnaire is depicted in Figure 3.3 and the complete questionnaire is given in Appendix 1. The constructs used in the study were quantified by a Likert-type scale using multiple-items and five point scale ranging from 1 (strongly disagree) to 5 (strongly agree). Total investment in plant and machinery and number of employee working in the organization are used as a measure of firm size (Oliveira *et al.,* 2014; Zhu *et al.,* 2006).

The questionnaire was reviewed by the academic researchers and subsequently pilot tested on some known SMEs. The results provided evidence that questions are understandable and scales are reliable. The factors and items used in the questionnaire were based on the published literature (Table 3-2).

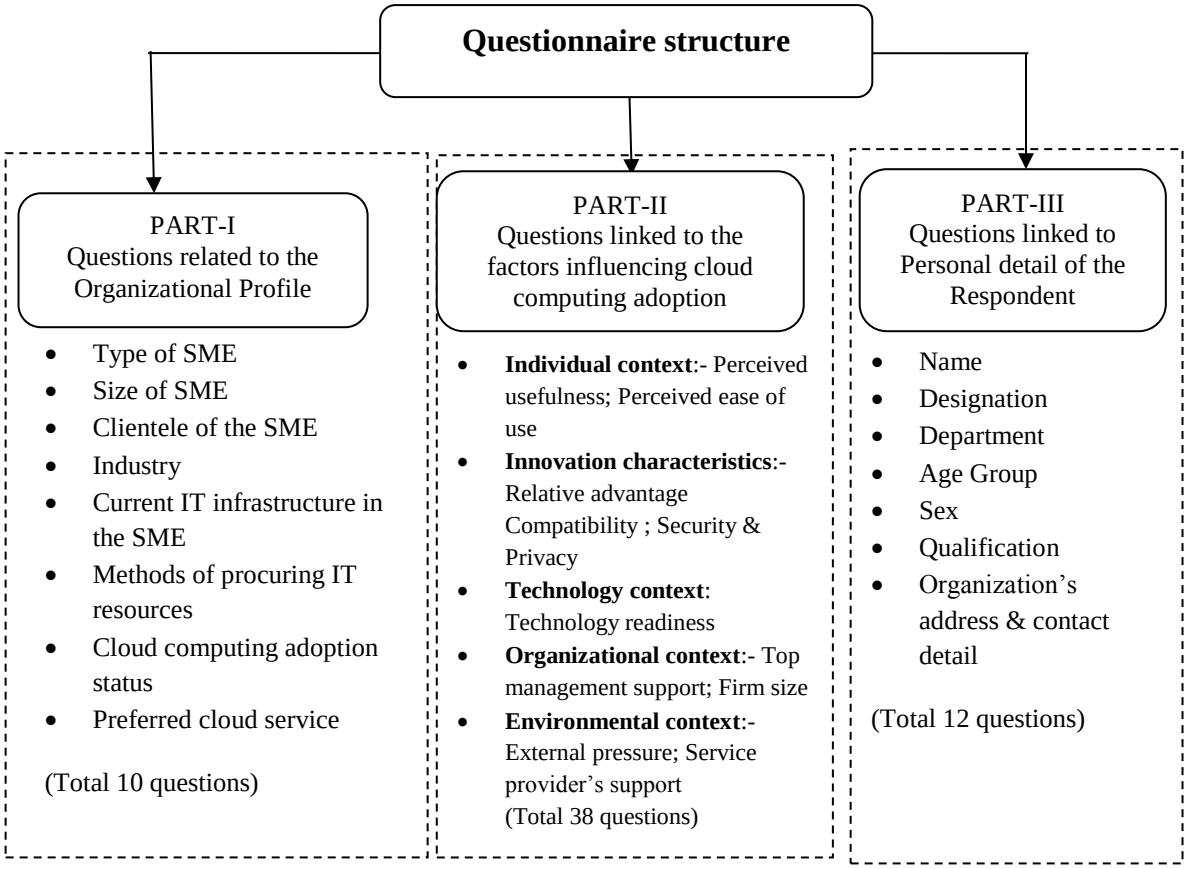

Figure 3.3 Structure of the questionnaire

Table 3-2. Sources of factors identified

Variable	**Source(s)**
Perceived usefulness	Gangwar and Date (2016), Wu(2011); Grandon and Pearson (2004)
Perceived ease of use	Gangwar and Date (2016), Gupta *et al.* (2013); Shah Alam *et al.* (2011);
Relative advantage	Al-Isma'ili *et al.* (2016); Oliveira *et al.* (2014); Safari *et al.* (2015); Geczy *et al.* (2012); Shah Alam *et al.*(2011); Wang *et al.* (2010)
Compatibility	Al-Isma'ili *et al.* (2016); Oliveira *et al.* (2014), Alshamaila *et al.* (2013); Wang *et al.* (2010)
Security and privacy	Oliveira *et al.* (2014), Safari *et al.* (2015); Gupta *et al.* (2013); Wu(2011); Shah Alam *et al.* (2011)
Technology readiness	Oliveira *et al.* (2014); Wu (2011); Wang *et al.* (2010)
Top management support	Al-Isma'ili *et al.* (2016); Oliveira *et al.* (2014), Gangwar *et al.* (2015), Wang *et al.* (2010), Ifinedo (2011)
Firm size	Oliveira *et al.* (2014); Alshamaila *et al.* (2013); Low *et al.*, 2011
External pressure	Oliveira *et al.* (2014); Alshamaila *et al.* (2013); Ifinedo (2011),
Service providers' support	Al-Isma'ili *et al.* (2016); Gangwar *et al.* (2015); Alshamaila *et al.* (2013); Ifinedo (2011)
Adoption intention	Gangwar *et al.* (2015); Wu(2011)

3.5 Data collection

In order to validate the theoretical framework developed in the previous stage, data was required to be collected from the appropriate respondents. The unit of measurement was SME and owner or head of that unit was mainly targeted for data collection as they were considered to be in the best position to answer all questions contained in the questionnaire. Considering the nature and novelty of the innovation being investigated in the present study, some minimum eligibility criteria were laid down for SMEs to become qualified for the survey. The SMEs were expected to have some basic ICT infrastructure in place and the units were also expected to be using some software applications for carrying out their business activities and the prospective SMEs were also expected to be aware of cloud computing. Therefore, for selecting SMEs for the survey, some screening questions were asked like- whether they are using ICT in some form, what ICT infrastructure they possess, what type of software applications they are using, and whether they are aware about cloud computing. A purposive sampling technique was therefore considered to be the most appropriate sampling technique for data collection related to the current research. In purposive sampling strategy, the respondents are chosen deliberately as they are expected to possess some predefined characteristics that allow the fundamental subject to be understood in greater detail (Saunders *et al.,* 2007). Purposive sampling technique is used by many researchers in various other similar studies (Carcary *et al.* 2014; Yeboah-Boateng and Essandoh, 2014; Park and Kim, 2014). Different agencies and offices were approached for getting contact information and other detail about the SME units which comprised – District Industry Centers, MSME Development Institute, the Confederation of Indian Industries, and industrial associations of different industrial area in Northern India.

The SMEs finally selected for the survey mainly comprised those enterprises which were members of Confederation of Indian Industries (CII), Northern Region Headquarters, Chandigarh. The reason for choosing these SMEs was that the member firms were likely to have some basic ICT infrastructure in place and further, the member SMEs were expected to be more aware about the importance of ICT and latest technological innovations such as cloud computing through various training programs/workshops/seminars organized by CII for its members on technological interventions for enhancing SME competitiveness. The MSMEs selected were mainly from three states- Himachal Pradesh, Punjab, and Haryana. The respondents were mostly owner/partners of the SMEs. The potential respondents were initially contacted through e-mail and telephone and certain screening questions were asked to reconfirm their suitability for the survey. Regular training programs/seminars/workshops

organized by CII were also utilized as a platform to directly communicate with the owners/managers of the SMEs wherein they were briefed about the survey and appropriate time was fixed for further data collection from those SMEs which were found suitable for the survey. Most of the responses were collected through personal visits. A total of 685 SMEs selected from the mentioned sources were finally found suitable for the survey and for further data collection. Questionnaires were distributed to the owners of these SMEs with prior intimation. Most of the responses were collected through personal visits. Other responses were collected through e-mails. Out of 685, 334 filled in questionnaires were gathered and 298 responses were found valid.

3.6 Reliability and validity of the instrument

In order to ensure the consistency and accuracy of the instrument, it is necessary to test the reliability and validity of the instrument. Further, to apply appropriate statistical techniques such as structural equation modeling or regression analysis, it is important to test whether the items making up the instrument establish decent measurement properties in terms of construct validity and reliability (Gefen *et al.*, 2000). Factor analysis and reliability analysis are the most commonly used tests for this purpose (Straub, 1989). Factor analysis using Principal Component Analysis (PCA) and varimax rotation was carried out in the present study which showed largely clean loading for most of the constructs. Reliability can be tested by using test-retest reliability method and internal consistency method. Because Likert's scale is used in the present study, therefore internal consistency method was employed to test the consistency of the test items. Average inter-item correlation for all the items used in the questionnaire for each individual construct was obtained separately. This was calculated in the form of Cronbach's alpha. The general rule of thumb provided by George and Mallery (2003) suggests that Cronbach's alpha values greater than or equal to 0.8 are considered as an acceptable reliability coefficient. In the current study, the Cronbach's alpha value of the entire item set as well as the item set for each of the individual construct were found to be more than or equal to 0.80, indicating a good reliability of the instrument. The validity of the instrument was further tested by using face validity method and by employing convergent and discriminant measures. All of these techniques confirmed a reasonable reliability and validity of the instrument.

3.7 Data Analysis

Data analysis was carried out by using different statistical techniques such as descriptive statistics, exploratory factor analysis, confirmatory factor analysis and structural equation modeling. IBM SPSS Statistics 20 was used for descriptive and factor analysis. Structural equation modeling was conducted using IBM SPSS Amos V21. A brief description of these techniques is provided in this section.

3.7.1 Descriptive statistics

Descriptive statistics are used to describe basic features of the data and to obtain summaries or profile about the sample and measures. Descriptive statistics enhances reader's understanding about the respondents. A large volume of data collected is reduced into simple summary by utilizing various descriptive statistics. In the present study, descriptive statistics are used for two purposes. Firstly, it is used to describe the profile of the SMEs covered for data collection. It summarizes the category-wise distribution of SMEs covered, size-wise distribution, their clientele, their current perception and status regarding cloud computing, ways and means of acquiring software by SMEs, and summary about the current status of ICT infrastructure. Secondly, descriptive statistics are used to measure central tendency of variables selected in the study by using mean values. Correlation among constructs, tolerance, and variance inflation factors are also used to check Multicollinearity issues.

3.7.2 Reliability analysis

The instrument developed in this study is based on Likert's scale. Various items used to measure different constructs are adapted from literature. Before employing advanced statistical tools and techniques for further data analysis, it is important to test the reliability and validity of the instrument. In this study reliability, which pertains to the consistency of the measure, is tested by using Cronbach's alpha values of all the constructs. Cronbach's alpha is the most commonly followed measure of internal consistency used by researchers. Validity, which is concerned with the genuineness of the measures, is tested by using various techniques such as face validity, construct validity, and convergent validity.

3.7.3 Factor analysis

Factor analysis is a multivariate statistical method which is used for summarizing information confined in a huge number of variables in lesser subsets of factors (Hair *et al.*, 1998;

Mazzocchi, 2008). Factor analysis is conducted on different measures to provide a factor structure. In the present study, factor analysis is mainly employed for getting an initial idea about the construct validity. Review of literature also reveals that factor analysis has long been associated with construct validity (Nunnally, 1978; Thompson and Daniel, 1996). Construct validity is measured in terms of convergent and discriminant validity. Hair *et al.* (2006) have defined convergent validity as "the extent to which the indicators of a specific construct converge or share a high proportion of variance in common". Convergent validity is therefore used to check whether items that aim to measure one construct truly measure that particular construct. Discriminant validity refers to "the extent to which a construct is truly distinct from other constructs both in term of how much it correlates with other constructs and how distinctly measured items, measure a single construct" (Hair, *et al.* 2006). Discriminant validity thus explains whether each item is determining only one construct or not. In other words, each construct should be distinctive from the rest. Factor analysis is used in this study by choosing principal component analysis and employing varimax rotation.

3.7.4 Confirmatory factor analysis (CFA)

One of the essential condition for applying CFA for data analysis is that the researchers must have a strong theory underlying their measurement model (Williams, 1985). The CFA technique allows the researcher to know how well their theoretical measurement of factors matches the actual data (Hair *et al.,* 2006). The results of CFA thus give an idea about confirmation or rejection of the predetermined theory. Confirmatory factor analysis helps in evaluating the influence of each scale item and to further test the validity of the scale (Hair *et al.,* 1998). A six-step process (Figure 3.4) suggested by Hair *et al.* (2006) is followed while applying SEM in the present context: "1. Defining individual construct, 2. Developing the overall measurement model, 3. Designing a study to produce empirical results, 4. Assessing the measurement model validity, 5. Specifying the structural model, 6. Assessing structural model validity" (Hair *et al.,* 2006, p.734).

As per the first step, described by Hair *et al.* (2006), all the eleven relevant constructs concerning the adoption of cloud computing by SMEs were defined. Individual items measuring each construct were also identified from the theory and the related literature. It was ensured that all the constructs and measures selected had a strong theoretical basis.

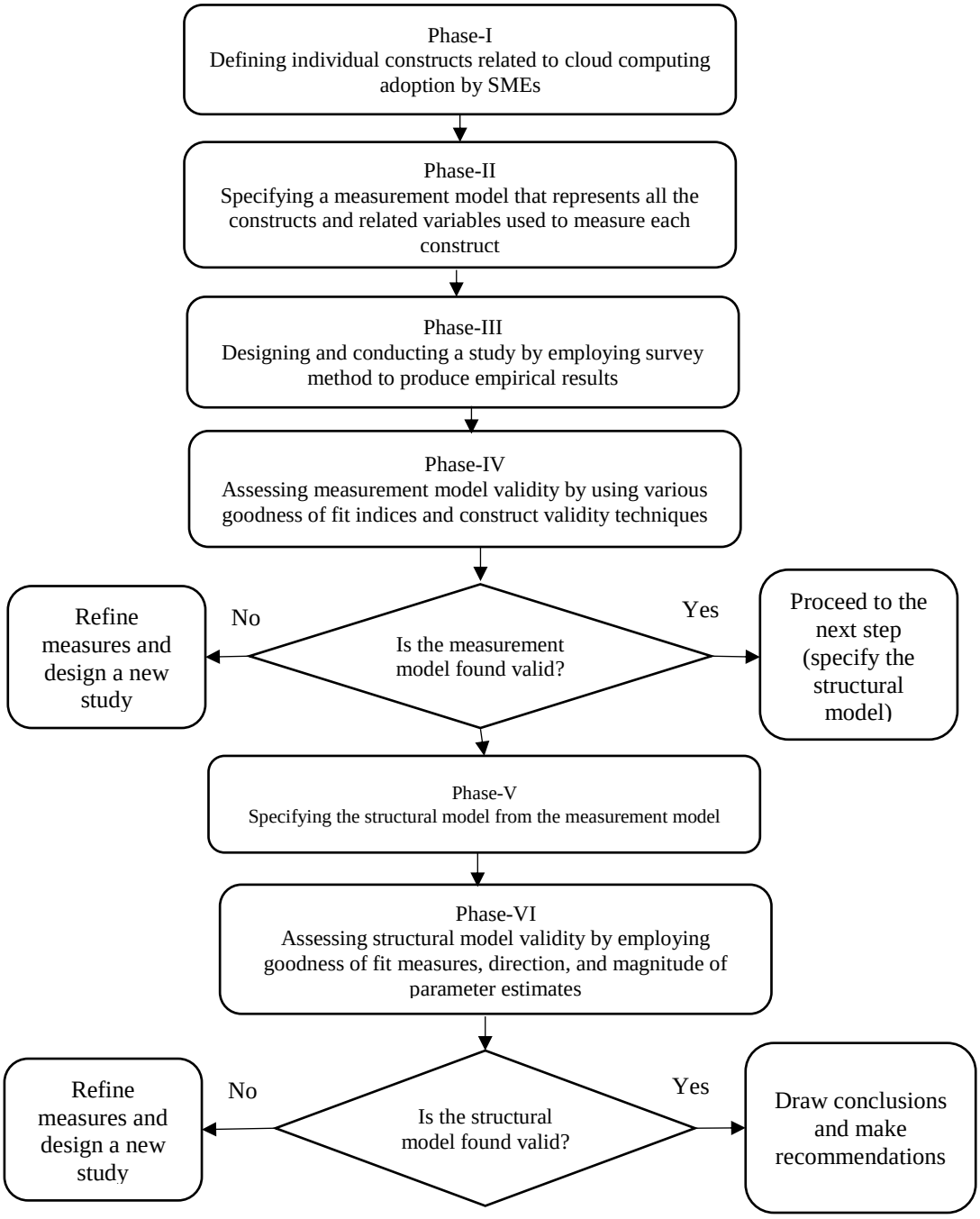

Figure 3.4 Structural Equation Modeling process (adapted from Hair *et al.* 2006)

A measurement model was specified on the basis of all the constructs and measures identified in the previous stage. A questionnaire based survey method was employed for data collection from the relevant respondents. The Data collected were then utilized for verifying the goodness of fit of the measurement model by employing various fit indices suggested by Anderson and Gerbing (1988); Chin and Todd (1995); and Hair *et al.* (2006). The goodness of fit indices used in the present study thus included – Chi square ($\chi 2$)/degree of freedom(DF);

Comparative Fit Index (CFI); Goodness of Fit Index (GFI); Adjusted Goodness of Fit Index (AGFI); Root Mean Square Error Approximation (RMSEA); Tucker-Lewis Index (TLI); and Incremental Fit Index (IFI). The results confirmed the adequacy of the model's fit. The quality of measures used in the research study is confirmed when favorable results are obtained from both the CFA outcomes and the construct validity tests (Hair *et al.*, 2006). Confirmatory factor analysis was therefore further used to test the construct validity before verifying the postulated paths using SEM, as suggested by Anderson and Gerbing (1988). Evaluating the construct validity is one of the main objectives of CFA/SEM (Hair *et al.,* 2006). Construct validity was measured in this study in terms of convergent validity and discriminant validity. CFA was thus employed to cover initial four steps in the six phase model provided by Hair *et al.* (2006).

3.7.5 Structural equation modeling (SEM)

"SEM is a family of statistical models that seek to explain the relationship among multiple variables, and it examines the structure of interrelationships expressed in a series of equations, similar to a series of multiple regression equations" (Hair *et al.*, 2006, p. 711). SEM is a unique statistical technique because it enables – estimation of multiple interrelated dependence relationships, the inclusion of latent variables not measured directly, and defining a model. SEM is rapidly becoming popular among researchers because of its theoretically interesting way to test the theory (Hair *et al.*, 2006). Having established the validity of the measurement model, a structural model was specified as per the step five of SEM process. A complete SEM model comprising both of the measurement and structural models was stated. Two types of relationships were depicted in the SEM model. The first type of relationship was of dependence type which is represented by a single headed arrow from an exogenous variable to the endogenous variable. The second type of relationship consisted of correlation associations which are denoted by two-headed arrows, which can be shared among exogenous variables only. The validity of the structural model was ascertained by employing various fit measures which were earlier used to test the validity of the measurement model. Upon obtaining favorable results of the fit indices, individual path coefficients related to the hypotheses postulated in the study were examined and conclusions were drawn accordingly.

CHAPTER 4
DATA ANALYSIS AND RESULTS

4.1 Introduction

Data collected from 298 SMEs were analyzed with the help of IBM SPSS Statistics 20 and IBM SPSS Amos 21.0. The characteristics of the data collected from the SMEs were analyzed to understand the respondent's profile. Descriptive statistics were used for calculating mean and standard deviation for the items selected to measure each construct of the proposed research model. Reliability of the scale was tested by calculating Cronbach's alpha for each of the factor. Exploratory factor analysis and confirmatory factor analysis were used to analyze the data. Structural equation modeling was further used to specify and assess the validity of the structural model and for testing hypotheses.

4.2 Respondent's profile

The sample size for this study was 298. Respondents mainly consisted of owner/business partners/top management personnel of the company. 89 percent of the respondents were male and female respondents were limited to only about 11 percent. About 51 percent of the total respondents were from the age group of 41 to 50 year old. 59 percent of the respondents were graduate and 40 percent were postgraduate. Out of the 298 SMEs, 30.9 percent were micro enterprises, 34.2 percent were small enterprises and remaining 34.9 were medium-sized enterprises. About 43 percent of the SMEs were six to ten years old. 30 percent of the total SMEs were having less than 25 employees and 21 percent SMEs have employee strength between 26 to 50. 22 percent of the SMEs were in the business related to engineering, electronics, and electrical products. 42 percent of the SMEs were from other category of industry type. 50 percent of the SMEs were having a nation-wide presence in terms of client base, whereas 23 percent SMEs have clientele in the nearby region only. Almost all of the SMEs were having basic ICTs such as computers, laptops, general software like MS office, accounting software. 63 percent of SMEs are planning to adopt cloud computing in some form in the near future, 15 percent have already adopted cloud computing and eight percent are using cloud computing on trial basis. About 82 percent of the SMEs are interested in adopting SaaS (Software as a Service) type of cloud computing. Sample characteristics are shown in Table 4-1.

Table 4-1 Sample characteristics (N=298)

Characteristics	Number	Percentage
Gender		
Male	266	89.26
Female	32	10.74
Age of respondent		
Age between 20 and 30 years	23	7.72
Age between 31 and 40 years	112	37.58
Age between 41 and 50 years	154	51.68
Above 50 years	9	3.02
Educational qualification		
Class 10^{th}	3	1.00
Class 12^{th}	4	1.34
Graduate	175	58.73
Post graduate	116	38.93
Organization type		
Micro Enterprise	92	30.9
Small Enterprise	102	34.2
Medium Enterprise	104	34.9
Total number of employees		
Less than 25	90	30.20
Between 25-50	63	21.14
Between 51-75	60	20.13
Between 76-100	37	12.42
More than 100	48	16.11
Organization's annual turnover		
Up to Rs. 5 Million	72	24.16
Above Rs. 5 million and up to Rs. 10 million	72	24.16
Above Rs. 10 million and up to Rs. 50 million	73	24.50
Above Rs. 50 million and up to Rs. 100 million	51	17.11
Above Rs. 100 million	30	10.07
Type of industry		
Auto components	25	8.39
Metal products	10	3.36
Pharmaceutical and biotech	28	9.40
Packaging	17	5.70
Food and agro products	11	3.69
Basic chemical and chemical products	14	4.70
Scientific instruments	3	1.00
Engineering, electrical and electronics	65	21.81
Others	125	41.95
Organization's clientele		
Local	47	15.77
Regional	69	23.15
National	147	49.33
International	35	11.74

Internet connection type		
Dial-up	4	1.34
Wireless	65	21.81
Leased line/DSL connection	55	18.46
Other type of connection	3	1.0
More than one type of connection	171	57.4
Basic productivity software (MS Office) available?		
Yes	291	97.65
No	7	2.35
Accounting software available?		
Yes	270	90.60
No	28	9.40
Plan to adopt cloud computing		
Already adopted cloud computing	47	15.77
Using cloud computing on trial basis	25	8.39
Planning to use cloud computing in next 2-3 years	187	62.75
Not planning to use cloud computing in near future	39	13.09
Type of cloud service preferred		
Individual software packages (SaaS)	244	81.88
Infrastructure services (IaaS)	3	1.01
System software as service (PaaS)	22	7.38
Security services	3	1.01
Combination of above services	26	8.72

4.3 Descriptive statistics

Table 4-2 presents the mean and standard deviation for items which are selected for each of the construct used to develop the research model. The mean values for all the constructs (except for security and privacy and for firm size) were found close to four or above four. This shows that respondents responded favorably to cloud computing at large.

Table 4-2 Mean and Standard Deviation (SD) of items (N=298)

Construct	Items	Mean	SD
Perceived usefulness	4	4.09	0.56
Perceived ease of use	4	4.18	0.57
Relative advantage	5	4.34	0.52
Compatibility	4	4.08	0.51
Security and privacy	3	3.30	0.64
Top management support	4	4.26	0.59
Firm size	3	2.44	1.10
Technology readiness	4	4.11	0.58
External pressure	4	4.14	0.63
Service Provider’s support	3	4.23	0.51
Adoption intention	3	4.53	0.52

4.4 Reliability analysis

The Cronbach's alpha coefficients pertaining to the hypothesized variables ranged from 0.729 to 0.900, that exceeded the recommended value of 0.50 (Hair *et al.,* 1998). These values show good internal consistency among scales used for the present study. The Cronbach's alpha values for all the 11 variables are shown in Table 4-3

Table 4-3 Reliability results

Factor	Number of items	Cronbach's alpha
Perceived usefulness	4	0.873
Perceived ease of use	4	0.878
Relative advantage	5	0.827
Compatibility	4	0.858
Security and privacy	3	0.862
Top management support	4	0.900
Firm-size	3	0.892
Technology readiness	4	0.874
External pressure	4	0.850
Service provider support	3	0.729
Adoption intention	3	0.864

4.5 Multicollinearity

In order to check the existence of a correlation between the independent variables, Pearson Product Moment Correlation (Pearson R) was calculated (Table 4-4). A correlation coefficient value above 0.9 is an indication of Multicollinearity issue (Cohen *et al.* 2002). The highest value of correlation coefficient in Table 4-4 is 0.644. Multicollinearity therefore, does not seem to be a problem.

Table 4-4 Correlation matrix

	PU	PEOU	RA	COMPT	SP	TMS	FS	TR	EP	SPS	AI
PU	1										
PEOU	.481**	1									
RA	.604**	.482**	1								
COMPT	.407**	.534**	.457**	1							
SP	.445**	.283**	.300**	.313**	1						
TMS	.524**	.510**	.526**	.476**	.266**	1					
FS	.034	.009	.089	.008	-.034	.022	1				
TR	.460**	.534**	.470**	.517**	.304**	.592**	.001	1			
EP	.591**	.547**	.538**	.577**	.364**	.610**	.020	.644**	1		
SPS	.266**	.268**	.367**	.313**	.144*	.333**	.181**	.393**	.246**	1	
AI	.411**	.459**	.524**	.437**	.179**	.564**	.022	.537**	.605**	.465**	1

** Correlation is significant at 0.01 level (2-tailed)

* Correlation is significant at 0.05 level (2-tailed)

Two alternative techniques suggested by Kleinbaum *et al.* (1988) were further employed for testing the Multicollinearity, which included Tolerance test and Variance Inflation Factor (VIF). The results are shown in Table 4-5. As suggested by Hair *et al.* (2006) a tolerance value below 0.1 and a VIF value above 10 is an indication of high Collinearity. Examining the values of tolerance and VIF from the Table 4-5, it is clear that all the values of tolerance are above 0.1, and all the values of VIF are below 10. These results indicate that Multicollinearity is not an issue in the model and the data set.

Table 4-5 Collinearity statistics

Independent variables	Collinearity Statistics	
	Tolerance	VIF
Perceived usefulness	.476	2.100
Perceived ease of use	.559	1.789
Relative advantage	.516	1.938
Compatibility	.560	1.786
Security and privacy	.771	1.297
Top management support	.499	2.003
Firm size	.953	1.049
Technology readiness	.460	2.172
External pressure	.393	2.546
Service provider's support	.752	1.329

4.6 Factor analysis

Bartlett's test of sphericity was first employed to confirm the suitability of the factor analysis, which is based on the correlation among the items. The significant level of this test (as shown in Table 4-6) confirms that there is an acceptable association between the items, and therefore the application of factor analysis is appropriate in the current context. Further, to test sampling adequacy of each variable considered in the research model and for the whole model, Kaiser-Meyer-Olkin (KMO) test results were utilized, which is based on the proportion of variance among variables. From the Table 4-6, it can be observed that KMO value was found to be 0.916, which is considered as outstanding (Kaiser, 1974). These values confirmed sampling adequacy and ensured factorability of the data.

Table 4-6 Sample adequacy test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.916
Bartlett's Test of Sphericity	Approx. Chi-Square	8239.023
	Df	820
	Sig.	.000

Factor analysis was mainly used in the current study to acquire a preliminary idea about the construct validity. The factor analysis was conducted using a principal component method with varimax rotation as an extraction method. Factor loadings for all the factors were found to be greater than the minimally acceptable level of 0.40, which indicates a significant loading for a sample size of about 200 (Hair *et al.* 2006). These values thus ensured the convergent validity of the scale. Discriminant validity of the scale was also reasonably ensured as per the results of factor analysis because most of the items loaded on to the hypothesized factors (except for external pressure). Items pertaining to the external pressure loaded on to the factor adoption intention, but these factors were treated as different variables for further analysis because these are considered as distinct factors in the theory and literature (Tornatzky and Fleischer, 1990). All the factors together accounted for 72.82 percent of the total variance, which implied that the extracted factors explained adoption intention to a very high level. The results of factor analysis are shown in Table 4-7.

Table 4-7 Factor loading

Factors and their items	Factor loading
Top management support	
Top management's attitude is positive towards using cloud computing	.799
Top management supports the implementation of cloud services	.796
Top management is ready to provide necessary resources for the introduction of cloud computing	.733
Top management accepts possible risks, which may result from introducing cloud computing	.701
Perceived usefulness	
Cloud computing services enable us to accomplish tasks more quickly	.760
Using cloud computing services give us greater control over our work.	.754
Cloud computing services will increase productivity	.731
Using cloud computing services would make my job easier	.705
Compatibility	
Cloud computing created changes are compatible with our business	.807
Usage of cloud computing service fits well with the way we like to work	.758
Cloud computing is compatible with our existing technology infrastructure	.756
Using cloud service is compatible with all aspect of our work	.672
Technology readiness	
Cloud computing is a familiar type of technology to use	.782
When we come to know about new information technology, we would look for ways to experiment with this new IT.	.737
Among peers, our firm is usually the first to adopt new information technologies.	.686
Overall, my organization has enough technical knowledge regarding technologies similar to cloud computing	.649
External pressure	

Our industry is pressuring us to adopt cloud computing	.583
Our business partners are already using cloud computing	.497
My company may acquire competitive edge if we use cloud computing	.430
Competition may prove to be an important factor in our decision to adopt cloud computing	.430
Perceived ease of use	
It would be easy for us to become skilful at using cloud computing services	.782
Overall we would find cloud computing services easy to use	.769
Our interaction with cloud computing services would be clear and understandable	.741
Learning to operate cloud computing services would be easy	.741
Relative advantage	
With cloud computing it is easy to 'scale-up' or 'scale-down' IT resources as per requirements.	.727
Upgrading/updating & maintenance of hardware & software is easy with cloud computing	.708
Use of cloud computing services reduces upfront costs (Initial investment on IT)	.695
Back-up & disaster recovery capabilities are better while using cloud computing	.612
By using cloud computing we can easily get access to latest information technologies.	.585
Firm size	
Organization's annual turnover	.930
Number of employees	.920
Investment in plant and machinery	.902
Security and privacy	
I am confident that cloud providers will not use my company's data for their own commercial benefits.	.899
The security systems built into the cloud computing services are strong enough to protect our data	.835
The confidentiality of business data is guaranteed when using cloud computing services	.782
Service provider's support	
Cloud service provider's reputation is an important factor while deciding about cloud computing implementation	.771
It is necessary to have adequate technical support after adoption of cloud computing services.	.724
It is important to have a good relationship with cloud service providers.	.702
Adoption intention	
Given easy access to cloud computing, I will recommend cloud computing implementation in my company.	.701
Assuming we have access to cloud computing, we intend to use it.	.691
Given that we have access to cloud computing , we predict that we would use it	.681
Note: Extraction method: principal component analysis; Rotation method: varimax with Kaiser normalization; Rotation converged in 7 iterations.	

4.7 Confirmatory factor analysis (CFA)

In order to confirm the factor structure and to examine the stability of scales, confirmatory factor analysis was used. Following the structural equation modeling process recommended by Hair *et al.* (2006), a measurement model was specified that consisted of the constructs and their respective measures defined in the previous phase. Three observed variables with lower factor loadings were deleted to improve the fit indices. Two variables measuring external pressure and one variable measuring vendor support were deleted. The measurement model was developed using IBM SPSS Amos V21 with maximum likelihood method (Figure 4.1). To assess the model fit, a variety of indices were used (Table 4-8). The analysis of data established a largely reasonable level of fit for the indices like- chi-square value divided by the degrees of freedom (χ^2/DF), the root mean square error of approximation (RMSEA), and the comparative fit index (CFI) as recommended by Hair *et al.* (2006). The CMIN/DF (chi-square/df) was obtained as 1.587 which is below the recommended level of absolute 5. The CFI (comparative fit index) obtained was 0.950, which is above the recommended level of 0.9. The RMSEA (root mean square error of approximation) obtained was 0.044, which is less than the recommended level of 0.05. This reflects a good model fit. These results confirm that the items describe their corresponding factors in the best manner. The goodness-of-fit Index (GFI) and adjusted goodness-of-fit Index (AGFI) were obtained as 0.859 and 0.828 respectively. The value of Tucker-Lewis index (TLI) was found to be 0.942, which is greater than the acceptable level of 0.90. Incremental fit index (IFI) was obtained as 0.951 which is also more than the acceptable level of 0.90. Thus the 11 factor model with a Chi-square statistic of 965.066 had the best overall fit to the data.

4.8 Convergent and discriminant validity using CFA

One of the primary objectives of CFA is to evaluate the construct validity of a proposed measurement theory (Hair *et al.,* 2010). Therefore, the study further verified the construct validity in terms of convergent and discriminant validity of the scales using confirmatory factor analysis results. Three tests namely- composite reliability (CR), average variance extracted (AVE), and maximum shared variance (MSV) were used to test the construct validity. The values of CR and AVE were used to verify the convergent validity whereas, MSV and the square root of AVE were used for testing discriminant validity (Anderson and Gerbing, 1988).

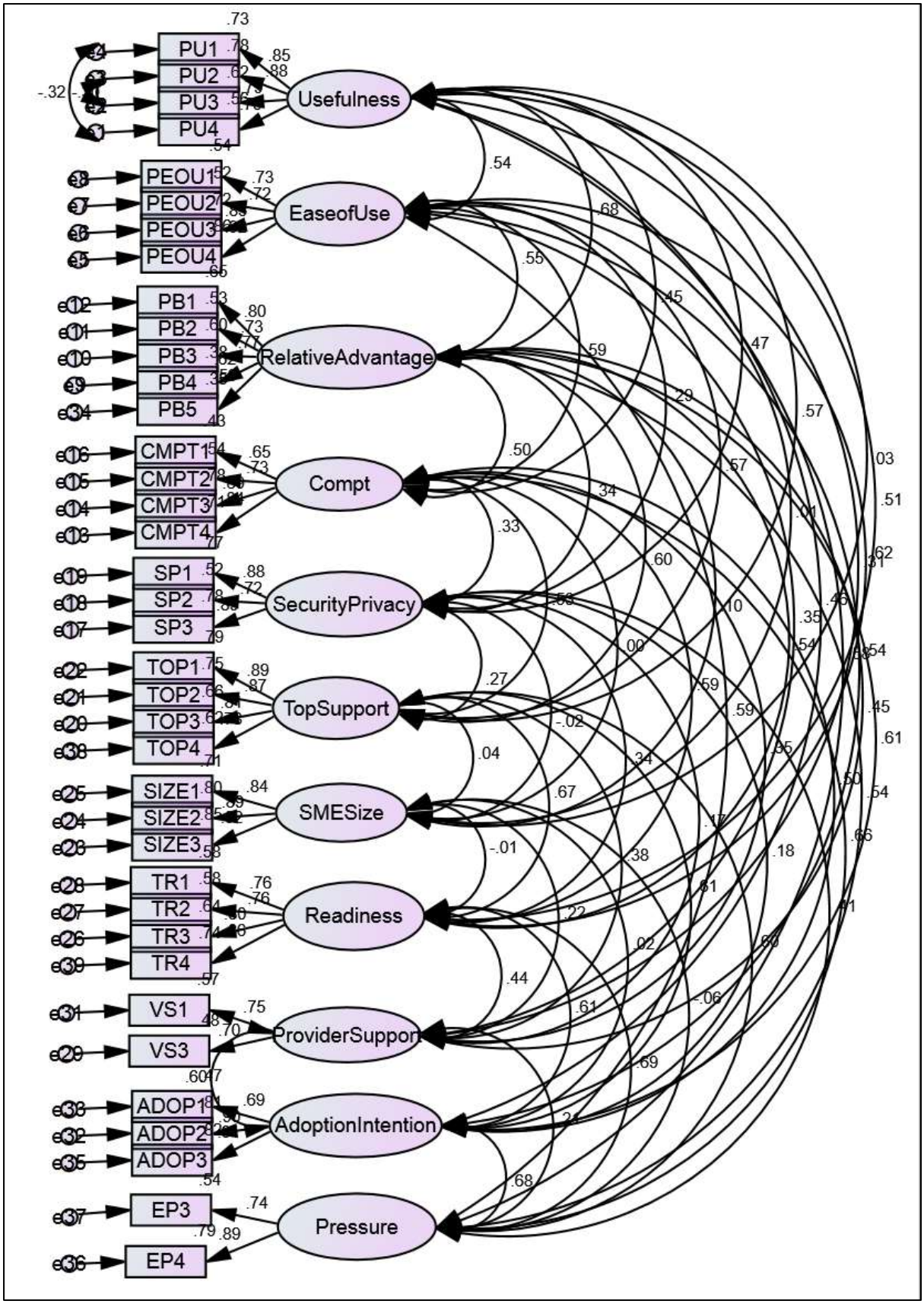

Figure 4.1: Measurement model

Table 4.8 Fit indices for the measurement model:

Measurement indices	Model Value	Recommended value*
Chi-Square (χ^2)/Degree of freedom(DF)	965.066/608=1.587	≤ 3.000
Comparative Fit Index (CFI)	0.950	≥ 0.9000
Goodness of Fit Index (GFI)	0.859	≥ 0.9000
Adjusted Goodness of Fit Index (AGFI)	0.828	≥ 0.8000
Root Mean Square Error Approximation (RMSEA)	0.044	≤ 0.05
Tucker-Lewis Index (TLI)	0.942	≥ 0.9000
Incremental Fit Index (IFI)	0.951	≥ 0.9000

* Recommended values adapted from Rana *et al.* (2016)

The results of convergent and discriminant validity tests are presented in Table 4-9 and Table 4-10. Composite reliability (CR) values for each construct were found in the range of 0.688 to 0.917 indicating acceptable to a high level of convergent validity (Hair *et al.,* 1990). Average variance extracted (AVE) values were found in the range of 0.50 to 0.78 for all constructs. These estimates are found above or equal to the threshold value of 0.50 (Fornell & Larcker, 1981). The results confirm the convergent validity of the scales.

Table 4.9 Confirmatory factor analysis (CFA) results

Measure	Composite Reliability(CR)	Average Variance Extracted(AVE)	Maximum Shared Variance(MSV)
Security & Privacy	0.869	0.690	0.219
Perceived usefulness	0.891	0.673	0.466
Perceived ease of use	0.884	0.658	0.388
Relative advantage	0.833	0.503	0.466
Compatibility	0.863	0.615	0.436
Top management support	0.906	0.707	0.452
Firm size	0.917	0.786	0.049
Technology readiness	0.874	0.634	0.471
Service provider support	0.688	0.524	0.356
Adoption intention	0.874	0.701	0.458
External pressure	0.799	0.667	0.471

Discriminant validity refers to the extent a construct is actually distinctive from the other constructs (Hair *et al.* 2010). In order to verify the discriminant validity of each construct the

tests suggested by Anderson and Gerbing (1988) were used. To qualify the first test, factor correlation among a pair of latent variables should be less than the square root of AVE of each variable as revealed in Table 4-10 by factor correlation matrix. The examination of this validity test indicates that the square root of AVE of each variable shown in bold across the diagonal of Table 4.10 is greater than the correlation value of each pair of variable. To qualify the second test of discriminant validity, MSV for each construct should be less than its respective AVE value (Table 4-9). The results of these tests show that each construct nominated in this study is different from other. Hence, discriminant validity of the scale is also confirmed.

Table 4.10 Factor correlation

Variable	SP	PU	PEOU	RA	CMPT	TMS	FS	TR	SPS	AI	EP
SP	**0.831**										
PU	0.468	**0.820**									
PEOU	0.292	0.536	**0.811**								
RA	0.345	0.683	0.553	**0.709**							
CMPT	0.331	0.447	0.594	0.500	**0.784**						
TMS	0.271	0.568	0.569	0.597	0.526	**0.841**					
FS	-0.021	0.034	0.008	0.103	0.000	0.035	**0.887**				
TR	0.337	0.505	0.623	0.538	0.588	0.672	-0.007	**0.796**			
SPS	0.166	0.311	0.348	0.447	0.351	0.382	0.222	0.443	**0.724**		
AI	0.181	0.456	0.540	0.608	0.499	0.612	0.022	0.610	0.597	**0.837**	
EP	0.410	0.580	0.592	0.538	0.660	0.595	-0.062	0.686	0.214	0.677	**0.817**

Note: Bold values across diagonal indicate square root of AVE

4.9 Structural equation modeling

The measurement model developed in the previous step was thus found valid and the results of convergent and discriminant validity were also supported empirically. A structural model was then specified as recommended by Hair *et al.* (2006) in the step-V of the structural equation modeling process. The validated measurement model was converted into a structural model by adding the structural type of relationships among constructs. All the constructs were now labeled as exogenous and endogenous variables. Adoption intention was hypothesized as endogenous variables and rest of the ten constructs became exogenous variables. The resulting structural model was assessed for validity by employing various goodness of fit measures as specified in step six of the structural equation modeling process by Hair *et al.* (2006). Values for these fit indices are provided in Table 4-11.

The values of fit indices confirmed the validity of the structural model. The CMIN/DF (chi-square/df) was obtained as 1.659 which is below the recommended level of absolute 5. The CFI (comparative fit index) obtained was 0.942, which is above the recommended level of 0.9. The RMSEA (root mean square error of approximation) obtained was 0.047, which is less than the recommended level of 0.05. This reflects a good model fit. The goodness-of-fit Index (GFI) and adjusted goodness-of-fit Index (AGFI) were obtained as 0.850 and 0.819 respectively. The value of Tucker-Lewis index (TLI) was found to be 0.933, which is greater than the acceptable level of 0.90. Similarly, the value of IFI (Incremental Fit Index) was obtained as 0.942, which is above the recommended threshold of 0.90. All these values established that the overall model fit is adequate.

Table 4-11 Fit indices for the structural model:

Measurement indices	Values	Recommended value
Chi-Square (χ^2)/Degree of freedom(DF)	1073.345/647=1.659	≤ 3.000
Comparative Fit Index (CFI)	0.942	≥ 0.9000
Goodness of Fit Index (GFI)	0.850	≥ 0.9000
Adjusted Goodness of Fit Index (AGFI)	0.819	≥ 0.8000
Root Mean Square Error Approximation (RMSEA)	0.047	≤ 0.05
Tucker-Lewis Index (TLI)	0.933	≥ 0.9000
Incremental Fit Index (IFI)	0.942	≥ 0.9000

Upon ensuring the validity of the structural model, various paths leading from exogenous variables to endogenous variables and magnitude of the path coefficients were examined to test the hypotheses and draw conclusions. A simplified version of the structural model depicting various path coefficients is shown in Figure 4.2.

4.10 Hypotheses testing results

It is recommended that the conclusion should be drawn only if the structural model is found to be valid (Hair *et al.*, 2006). Therefore, upon establishing the comparative capability of the model's fit, all the path coefficients corresponding to the hypotheses formulated in this study were inspected. The analysis is presented in Table 4-12. Out of ten hypotheses proposed, five were found significant. The research model described 72 percent of cloud computing acceptance intention by SMEs.

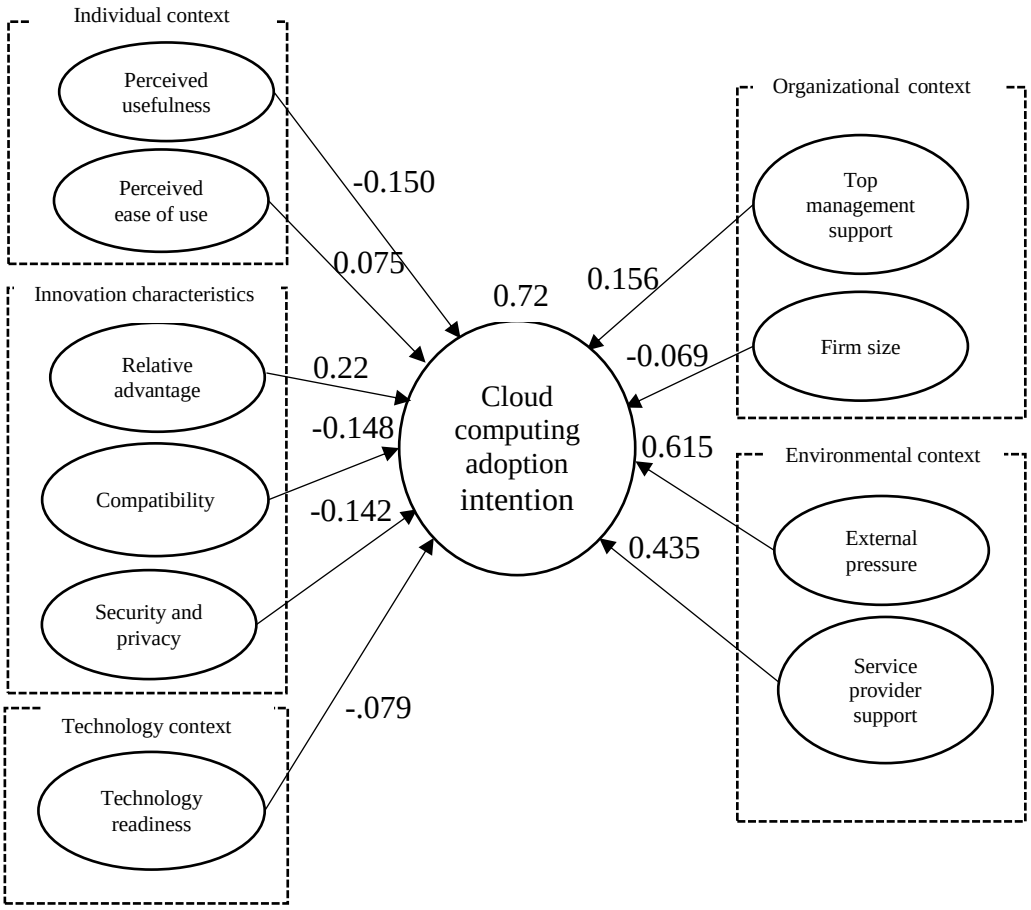

Figure 4.2 Structural model

Examining the path coefficients in the structural model revealed that external pressure was the most influential factor in cloud computing adoption by SMEs with a path coefficient value of 0.615, followed by service provider's support (0.435). The relative advantage came at third place with standardized path coefficient value of 0.22 followed by top management support (0.156). Security and privacy concern (-0.142) was the fifth factor that negatively influenced SMEs intention to adopt cloud computing.

4.10.1 Hypothesis H1: Perceived usefulness positively influences SME's intention to adopt cloud computing.

The first hypothesis H1 is represented by path coefficients as Perceived usefulness → Adoption intention. It is not supported in the structural model. The standardized path coefficient (-.150) was not found statistically significant (p = .076) and was found negative.

Table 4-12 Hypotheses testing

Sl. No.	Path	Standardized path coefficients	CR	p-value	Result
H1	Perceived usefulness → Adoption Intention	-.150	-1.772	.076	Not supported
H2	Perceived ease of use → Adoption Intention	.075	1.088	.276	Not supported
H3	Relative advantage → Adoption Intention	.224	2.647	.008	**Supported**
H4	Compatibility → Adoption Intention	-.148	-1.915	.055	Not supported
H5	Security and privacy → Adoption Intention	-.142	-2.533	.011	**Supported**
H6	Technology readiness → Adoption Intention	-.079	-.834	.404	Not supported
H7	Top management support → Adoption Intention	.156	2.109	.035	**Supported**
H8	Firm size → Adoption Intention	-.069	-1.450	.147	Not supported
H9	External pressure → Adoption Intention	.615	5.208	.000*	**Supported**
H10	Service provider support → Adoption Intention	.435	5.478	.000*	**Supported**

Note: CR-Critical Ratio, p value-Significance, * p value < 0.001

4.10.2 Hypothesis H2: Perceived ease of use positively influences SME's intention to adopt cloud computing.

The second hypothesis is represented as Perceived ease of use → Adoption intention, in the structural model. The path coefficient for this hypothesis was found as 0.075 with a p value of 0.276. This hypothesis was thus not supported in the present study.

4.10.3 Hypothesis H3: Relative advantage of cloud computing positively influences intention to adopt cloud computing by SMEs.

Hypothesis 3 is represented by path coefficients as Relative advantage → Adoption intention. This hypothesis was supported in the structural model. The standardized path coefficient (0.224) was found statistically significant (p = .008) with a positive sign.

4.10.4 Hypothesis H4: Compatibility positively influences intention to adopt cloud computing by SMEs.

The fourth hypothesis H4 is represented as Compatibility → Adoption intention by path coefficients. The standardized path coefficient for this hypothesis was found as -0. 148, with a p value of 0.055. The hypothesis was therefore, not supported.

4.10.5 Hypothesis H5: Security and privacy concerns negatively influence SME's intention to adopt cloud computing.

The fifth hypothesis H5 is represented by path coefficients as Security and privacy → Adoption intention. This hypothesis was supported. The path coefficients pertaining to this hypothesis was found as -.142 with a p value of 0.011. The sign of the coefficient was also found negative.

4.10.6 Hypothesis H6: Technology readiness positively influences SME's intention to adopt cloud computing.

Hypothesis H6 is represented by path coefficients as Technology readiness → Adoption intention. The standardized path coefficient for the hypothesis was found -.079 with p value of 0.404. This hypothesis was therefore not supported by the data collected in this study.

4.10.7 Hypothesis H7: Top management support positively influences SME's intention to adopt cloud computing.

The seventh hypothesis H7 is represented as Top management support → Adoption intention. The standardized path coefficient for this hypothesis was found as 0.156 with p value of 0.035. The hypothesis was therefore accepted.

4.10.8 Hypothesis H8: Firm size positively influences SME's intention to adopt cloud computing.

Hypothesis H8 is represented by path coefficients as Firm size → Adoption intention. The path coefficient for this hypothesis was found as -.069 with a p value of 0.147. The hypothesis was therefore rejected.

4.10.9 Hypothesis H9: External pressure positively influences intention to adopt cloud computing by SMEs.

The ninth hypothesis is represented by path coefficients as External pressure → Adoption intention. This hypothesis was supported by the data because standardized path coefficient (0.615) was found statistically significant (p = .000).

4.10.10 Hypothesis H10: Service providers' support positively influences SME's intention to adopt cloud computing.

The last hypothesis H10 is represented as Service provider's support → Adoption intention. The standardized path coefficient for this hypothesis was found as 0.435 with p value of 0.000. This hypothesis was thus supported by the data.

CHAPTER 5
DISCUSSION

5.1 Introduction

This chapter provides a summary of the study that begins with highlighting some of the important characteristics of the respondents followed by a brief overview of the objectives of the study and discussion about the results, comparison of results with the literature and researcher's interpretation about the findings. Theoretical and practical implications of this study are also provided in this chapter.

5.2 Discussion about sample profile

The sample characteristics were analyzed using frequency distribution. Most of the respondents were male (89.26%) and the majority of respondents (51.68%) belong to the age group in the range of 41-50 years. With respect to the level of education, 58.73 % of the respondents had attained undergraduate degree whereas, 38.93% of the respondents had attained post graduate degree. Within SMEs, all the enterprises were fairly and evenly distributed in the category of "micro" (30.9%), "small" (34.2%) and "medium" (34.2%) enterprises. All the SMEs had basic ICT infrastructures available with them, such as personal computers, laptops, internet connection, basic productivity software and accounting software. A majority of the respondents (66.78%) claimed that they have their own website. Out of 298 SMEs, 62.75% of the SMEs are planning to use cloud computing in the near future and 81.88% of the SMEs have preferred to use Software as a Service (SaaS) type of cloud computing service.

5.3 Discussion about the results

This study was aimed at assessing factors influencing adoption of cloud computing by SMEs in India. For this, an integrated framework that joined three theoretical models-TAM, DOI, and TOE framework, was proposed and tested empirically. The results indicated that factors persuading the adoption of cloud computing among SMEs include relative advantage, security and privacy, top management support, external pressure and service providers' support. Table 5-1 presents a summary of hypotheses that are accepted and rejected.

Table 5-1 Summary of hypotheses

Individual context	
H1: Perceived usefulness	Rejected
H2: Perceived ease of use	Rejected
Innovation characteristics	
H3: Relative advantage	Accepted
H4: Compatibility	Rejected
H5: Security and privacy	Accepted
Technological context	
H6: Technology readiness	Rejected
Organizational context	
H7: Top management support	Accepted
H8: Firm size	Rejected
Environmental context	
H9: External pressure	Accepted
H10: Service provider's support	Accepted

5.3.1 Innovation characteristics

Of the three characteristics of innovation, the relative advantage (H3) and security and privacy (H5) were found statistically significant. The relative advantage was found to positively influence the SME's intention towards adopting cloud computing. Relative advantages of cloud computing identified in this study included flexible and usage-based payment options, cost benefits, enhanced scalability, and simpler set-up and upgrade process. This finding is consistent with other similar studies found in the literature (Oliveira *et al.,* 2014; Gangwar *et al.,* 2015; Infinedo, 2011). This finding confirms the importance of relative advantage in the acceptance of novel technology like cloud computing by the SMEs. The chances of adoption of a technology increase if organizations are aware of the technology's comparative advantages. Therefore, it can be assumed that, if SMEs perceive cloud computing beneficial in terms of cost advantage, improved scalability, and easier to implement and maintain, then the probability of cloud computing adoption by SMEs is going to be high. Security and privacy (H5) emerged as a significant concern for SMEs. It is revealed in this study that security and privacy concerns negatively influence SME's intention to adopt cloud computing. This means that SMEs are apprehensive about the security mechanism built in the cloud computing

environment and therefore, SMEs feel reluctant in migrating their data onto the cloud. This finding is in line with a similar study on cloud computing adoption (Yeboah-Boateng, 2014). However, the results of this study are different from the findings reported by Gupta *et al.,* (2013) and Safari *et al.,* (2015), where security and privacy are found as a significant factor that positively influence intention to adopt cloud computing by organizations. This means that SMEs are satisfied with current security arrangements. This difference in security perceptions may be due to the difference in the contexts of these studies. Compatibility (H4) is not found significant in influencing SME's intention to adopt cloud computing. This may be attributed to the fact that as cloud computing does not require any special kind of software and hardware as it can be implemented with existing ICT infrastructure which is commonly found among all organizations. Moreover, the SMEs included in the survey were selected on the basis of availability of basic ICT infrastructure. Therefore, compatibility may not be a significant issue for the SMEs for adopting cloud computing. Compatibility is also not found significant in other similar studies (Low *et al.,* 2011; Borgman *et al.,* 2013).

5.3.2 Technology context

Technology readiness (H6), which refers to the availability of technological and human resources within the organization, was hypothesized as a facilitator of adopting cloud computing by the SMEs. The study finds that technology readiness is not significant and therefore, may not influence SME's intention to use cloud computing. Cloud computing requires normal computer systems, basic networking and a reliable internet connection and someone with basic computer skills to access and operate applications in a cloud environment. The SMEs were screened on the basis of the availability of such an infrastructure. The respondents were mainly the owner of SMEs, who are expected to make use of cloud computing. The respondents thus assumed that they have the required technological infrastructure and expertise to adopt cloud computing. This may be the explanation for the less concern expressed by the respondents towards technology readiness as they assume their technology readiness as obvious. Technology readiness is also found non-significant in other similar studies on cloud computing adoption (Low *et al.,* 2011, Wu *et al.,* 2013).

5.3.3 Organizational context

Top management support (H7) emerged as an important factor that positively influences SME's intention to accept and use cloud computing. This study confirms that support provided

by top management plays a significant role in influencing intention to adopt cloud computing among the Indian SMEs. This factor assumes more importance in an Indian context where top management usually comprises owners of the SMEs only, and their awareness and perception about any innovation such as cloud computing is likely going to influence its adoption in the organization. Owner centric nature of the Indian SMEs, therefore, makes owner's opinion very crucial for the successful adoption of any new ICT within the SME. Owners positive perception about cloud computing is also reflected in this study from the analysis of three questions asked in the first part of the questionnaire which were related to the organizational profile. The majority of the respondents are planning to adopt cloud computing in near future. These facts justify the results of this study which highlight the important part of top management in cloud computing adoption by the SMEs. Similar results are reported in other studies (Low *et al.*, 2011; Infinedo, 2011; Alshamaila *et al.*, 2013).

The hypothesis related to the firm size (H8) is not supported in this study. This implies that the size of the firm does not influence adoption of cloud computing amongst SMEs. Mixed type of results are found in the literature regarding significance and correlation of firm size in cloud computing adoption. In some studies, firm size is reported as significant predictor of cloud computing adoption, which positively influence intention to adopt cloud computing (Oliveira *et al.,* 2014; Low *et al.,* 2011). These findings show that larger firms are more likely to adopt cloud computing as these have more resources and more risk taking capacity. Other studies confirm firm size as significant factor that negatively influence intention to adopt new IT (Alshmaila *et al.,* 2013; Oliveira and Martins, 2011). Flexibility and less formal organizational structure of smaller firms make these firms more eligible and ready for new IT innovation adoption. Firm size is also reported as insignificant factor in a study by Borgman *et al.* (2013). In the present study, all the firms belong to SME category and a small difference existed in their sizes in terms of employees, turnover, and investments. Further, these SMEs have similar type of ICT requirements. This may be the explanation for getting firm size as an insignificant factor in the present context. Further, a negative path coefficient value (-0.047) from firm size to adoption suggested that firm size was negatively related to cloud computing adoption.

5.3.4 Environmental context

Both of the variables in environmental context - external pressure and service providers' support, were found significant in influencing SME's intention to adopt cloud computing. This

implies that Indian SMEs are highly influenced by external environmental factors in their efforts towards adopting cloud computing. External pressure (H9) from competitors, suppliers and other business partners positively influence cloud computing adoption intention by the SMEs. The probability of adopting cloud computing by SMEs is going to be higher if their business partners, competitors and customers are also using cloud computing. This finding is found in line with other related studies (Gangwar *et al.,* 2015; Safari *et al.,* 2013; Low and Chen, 2011; Low *et al.* 2011; Infinedo, 2011). Service providers' support (H10) is revealed to positively influence the intention to accept cloud computing by SMEs. Being a new technology, SMEs will rely more on service providers' support for the uninterrupted availability of cloud services. The service provider's support in the form of initial training, better customer service and technical support become very crucial for SMEs in order to adopt cloud computing. Better perceived support from the cloud vendor's side will increase the chances of cloud computing adoption by the SMEs. Gangwar *et al.* (2015) have reported similar results, and they have termed it as trading partner support. Alshamaila *et al.* (2013) have also found service provider support as a significant determinant of cloud computing adoption.

5.3.5 Individual context

Both of the variables in the individual context (perceived usefulness and perceived ease of use) were found insignificant in influencing intention to adopt cloud computing by SMEs. This may be attributed to the fact that cloud computing, as such is not a new information technology. Enterprises are already using different ICTs to support their business activities and, cloud computing is only a new and innovative way to deliver various kind of ICTs to customers in a cost effective manner. Therefore, perceived usefulness regarding system usage might not be a substantial issue for the respondents in the present context. Same is the case with perceived ease of use. Organizations are already using information systems, and employees are well versed in using these systems. Cloud computing is only going to bring a minor change in the manner in which the ICTs are accessed. Perceived ease of use therefore, may not appear an important matter for the respondents in cloud computing adoption. This does not essentially mean that perceived usefulness and perceived ease of use are not important for SMEs in cloud computing adoption. Rather, the usefulness and ease of use associated with using cloud computing are implied, as there is not much of difference in the way the ICT applications are accessed and used in traditional on-premise model and in cloud computing environment. This may be the possible explanation for less concern shown by the respondents towards these two

factors. Shah Alam and Ali (2011) have reported similar results for perceived ease of use in a study on e-commerce adoption among SMEs in Malaysia.

5.4 Implications of the study

The findings of this study offer both theoretical and practical implications. The important implications are discussed in this section.

5.4.1 Theoretical implications

The study makes significant contribution towards body of knowledge on the adoption of new technologies such as cloud computing among small and medium-sized enterprises. This is one among a very few studies that attempts to rigorously examine the factors influencing adoption of cloud computing by the Indian SMEs using strong theoretical basis and empirical testing. Many researchers have called for joining various theoretical models to enhance understanding about the adoption of different pioneering technologies in organizations (Oliveira *et al.,* 2014; Wu *et al.,* 2013; Oliveira and Martin, 2011). The research framework used in this study is therefore developed by considering various perspectives taking clue from three prominent theoretical models (TAM, DOI and TOE). The resulting integrated framework is expected to strengthen the predictive power of the model. The model combines individual context (perceived usefulness and perceived ease of use from SME owner's perspective) and innovation characteristics (relative advantage, compatibility, security and privacy) with three contexts of TOE framework (technological, organizational and Environmental). No study has conceptualized and empirically tested such a framework. The instrument developed based on this model is confirmed for reliability, validity and discriminant checks by utilizing data collected from 298 SMEs. The application of SEM (considered as a statistically powerful technique) further confirms a good measurement and structural model fit. The framework tested in this study along with the instrument used for data collection thus provide a new insight about adoption of cloud computing among SMEs. The validated instrument used for data collection and empirically tested research framework can also be adopted in other similar studies. The study, therefore, is not only novel in many ways but also intends to address research gaps identified in previous studies (Al-Isma'ili *et al.,* 2016; Oliveira *et al.,* 2014; Alshamaila *et al.,* 2013).

5.4.2 Practical implications

The results of this study show that external pressure, service providers' support, the relative advantage, top management support, and security concerns are the significant factor

instrumental in forming a positive attitude towards adopting cloud computing by SMEs. The findings will help decision makers in SMEs in evaluating their readiness for adopting cloud computing by carefully examining the factors revealed. The first factor that managers in SMEs consider most important while planning to adopt cloud computing is external pressure. External pressure from competitors and business partners is revealed as an important factor influencing SME owners' intention to adopt cloud computing. SMEs are looking for ways and means to make their processes more efficient and increase their market reach to become more competitive. This is possible by utilizing latest ICTs, and cloud computing has the potential to make this possible in a cost effective manner. Service providers' support emerged as the second important factor. Cloud computing is still in nascent stage, and SMEs are not fully aware of operational issues involved in its adoption. Therefore SMEs need more hand holding and support in the initial phases. Service providers' support thus becomes very crucial for successful adoption of cloud computing. With service provider's active support, SMEs can fully utilize cloud computing for the improvement of their businesses and can also manage other challenges like security and privacy concerns in a better way. The relative advantage was revealed as the third important factor. The relative advantage of cloud computing is demonstrated in the form of cost benefits, scalability, ease of installation and maintenance, improved back-up, and easier access to latest IT. Therefore, managers in SMEs will plan to adopt cloud computing only if they find it relatively advantageous. Top management support emerged as the fourth significant factor. Top management support is also important in making a positive impact on SME's intention to adopt cloud computing. Top management in the Indian SMEs mostly comprises of owners and all the decision making is done by them only. If top management is aware of the benefits of latest technological developments for their businesses, then they are certainly going to provide support and release necessary resources to adopt that technology. The fifth factor - security and privacy concern, emerged as a serious challenge for SMEs. Managers in SMEs are not fully convinced about security and privacy protection in cloud computing environment. The service providers need to educate organizations about the security mechanisms implemented in cloud computing to win their confidence. The awareness and understanding among SMEs about security procedures and policies used by service providers will make a positive impact on SME's intention to adopt cloud computing.

The findings of this study will also help cloud computing service providers in better understanding the perceptions, needs, and requirements of SMEs. They will also come to know about the concern areas in cloud computing adoption by SMEs. In fact, service providers' support has emerged as the most significant factor in this study, which shows the importance

of the role of service providers in cloud computing adoption by SMEs. All these facts will help providers in improving their strategies and approaches to promote adoption of cloud computing by SMEs.

Policy makers and various government and non-government organizations engaged in the promotion and development of SMEs will also find results of this study useful in their efforts to increase ICT penetration among SMEs. The favorable legislative framework and a good power and telecommunication infrastructure are of paramount importance for the large scale adoption of cloud computing by SMEs, which can only be improved by the active participation and support by the government.

Chapter 6

CONCLUSION

6.1 Introduction

This chapter presents concluding comments about the entire study. The purpose of the study was to evaluate the factors influencing cloud computing adoption among SMEs in India. For this, a conceptual framework was proposed and tested empirically. Conclusions were drawn on the basis of statistical analysis performed on the data collected from 298 SMEs. The chapter-wise summary is provided in the following sections.

6.2 Summary of literature review

The literature review was divided into five sections. Initially, prominent theories related to the adoption of information technology/information systems by individuals and organizations were reviewed and three theoretical models relevant in the present context were identified. The second section covered a summary of studies related to the adoption of ICT among SMEs. This review was aimed at understanding the extent of ICT adoption among SMEs through the related research studies, identifying the factors influencing ICT adoption, and finding the challenges faced by SMEs while adopting ICTs. Research work carried out in the area of cloud computing adoption among organizations of various types was then reviewed. Finally, some of the studies found on cloud computing adoption among SMEs were reviewed. The literature review helped in understanding the research work reported in the area of interest as well as in identifying the research gaps.

6.3 Summary of research design

The process followed in the research design was described at the beginning of this chapter. The research framework developed on the basis of theoretical models and the literature review was then presented, followed by hypotheses formulation procedure. All the ten hypotheses proposed were described. Questionnaire development method followed in this study was described in detail. Sampling methodology used for data collection was then described followed by data analysis strategy adopted in this research work. Purpose and justification for using various statistical methods like the descriptive statistics, factor analysis, confirmatory factor analysis and structural equation modeling were also discussed in this chapter.

6.4 Summary of data analysis and results

Analysis of the respondents profile indicated that majority of the SMEs (86 percent) were planning to adopt or have already adopted cloud computing in some form. About 82 percent of the SMEs showed their inclination towards Software as a Service (SaaS) model of cloud computing. Results of descriptive statistics further confirmed the favorable response towards cloud computing by the respondents.

The results of reliability analysis revealed good internal consistency among scales used in this study. The Cronbach's alpha coefficients pertaining to the hypothesized variables ranged from 0.729 to 0.900, that exceeded the recommended value of 0.50 (Hair *et al.,* 1998). Sampling adequacy and factorability of the data was confirmed with acceptable values of the Kaiser-Meyer-Olkin tests. Factor loadings for all the items were found above the minimum acceptable level of 0.40 (Hair *et al.* 1998). The results of factor analysis further revealed that all the factors together accounted for 72.82 percent of the total variance, which implied that the extracted factors explained adoption intention to a very high level.

The factor structure and stability of the scales were confirmed by employing confirmatory factor analysis (CFA). The values of various fit indices pertaining to the measurement model reflected a good model fit. Positive results of the tests suggested by Anderson and Gerbing (1988) confirmed the convergent and discriminant validity of the scales. Upon getting favorable results from the CFA, a structural model was specified and tested as recommended by Hair *et al.* (2006). The values of a variety of fit indices proved the validity of the structural model. Conclusion related to hypotheses were drawn on the basis of the analysis of the path coefficients and the related p values. The research model explained 72 percent of cloud computing adoption intention by SMEs. Out of ten hypotheses, five were supported, which included hypotheses relating to external pressure, service provider's support, the relative advantage, top management support, and security concerns.

6.5 Theoretical contribution of the study

The present study makes an important contribution towards the body of knowledge on the acceptance of ICT and cloud computing among SMEs. Firstly, the research framework proposed in this study intends to be more holistic as it integrates three prominent theoretical models which incorporates individual perspective (TAM), innovation characteristics (DOI), and technological, organizational and environmental contexts (TOE framework). The ensuing model is dissimilar from the other models used by the researchers in related studies because

these fall short of holistically assessing the combined effect of individual characteristics, innovation characteristics, and contextual factors on SME's intention to adopt cloud computing. The model is empirically tested with data collected from a large sample (n = 298). The instrument employed in the study is confirmed for the reliability and validity tests. It is, consequently, reasonable to accomplish that the research framework and the instrument used for data collection, provide a comprehensive basis for assessing factors influencing the adoption of cloud computing among SMEs. The present study thus, not only attempts to fill the research gaps found in cloud computing adoption among SMEs but also provides an empirically tested model and data collection tool, which can be adapted for use in other innovations and contexts.

6.6 Managerial and practical contribution of the study

The findings will help SMEs in evaluating their readiness for adopting cloud computing by carefully examining the factors identified. The results of this study show that external pressure, service providers' support, the relative advantage, top management support and security concerns are important factors that contribute significantly in forming a positive attitude amongst SMEs towards adopting cloud computing. Service providers are also benefited in terms of their enhanced understanding about the SMEs requirements and their concerns related to cloud computing adoption. Various agencies and government backed organizations which are engaged in promoting and supporting SMEs can also find this study useful in their efforts to accelerate ICT adoption among SMEs through cloud computing.

6.7 Limitations of the study

The results of this work should be interpreted in light of study's limitations. Firstly, the term SME used in the study is based on the definition provided by Government of India. According to this definition, firms are categorized as micro, small and medium enterprise based on the total investment made in plant and machinery. This definition is different from the ones used in the other studies and in other countries where SMEs are defined on the basis of a number of employees and yearly revenue. Second, although the sample size was adequate for this study, it cannot be considered sufficient for generalizing results for all the SMEs. It may have a regional limitation because the data collected for this study comprised SMEs from only one region in India. Most of the SMEs are manufacturing organizations covering various industry types. Third, the variables considered in this study may not be sufficient while testing some other technologies in other contexts.

6.8 Suggestions for future research

Several recommendations emerge from this study. First, the adoption of cloud computing can be assessed by covering more SMEs from different other regions of India. Industry-wise adoption of cloud computing can also be attempted within SMEs. Second, the study can be extended to some other countries also. Third, the research framework used in the study can be applied in assessing adoption of other different kinds of ICTs in diverse contexts. Fourth, some additional variables may also be utilized on the basis of the innovation being investigated and the location of the research study.

6.9 Conclusion

Cloud computing has huge potential to increase ICT penetration among organizations in a very cost effective way. Through cloud computing, SMEs can get access to relevant ICTs in a secure, cost-effective and convenient manner, which will help them to compete and grow. This research work attempts to evaluate contributing factors relating to the adoption of cloud computing among SMEs in India. Three theoretical perspectives are integrated into this study to arrive at a research framework, which is further empirically tested with data from 298 SMEs in India. Ten hypotheses were proposed based on the literature review. Five hypotheses were supported. The results indicate that external pressure, service providers' support, the relative advantage, top management support and security concerns are important factors that influence cloud computing adoption among SMEs. One important concern area is also highlighted in this study which is related to security and privacy concerns arising in cloud computing adoption. The research work is thus, a distinct attempt and an important contribution towards understanding the adoption of innovations like cloud computing among SMEs.

REFERENCES

Abdollahzadehgan, A., Gohary, M. M., & Amini, M. (2013). The Organizational Critical Success Factors for Adopting Cloud Computing in SMEs. *Journal of Information Systems Research and Innovation*, 4(1), 67-74.

Abdullah, I., & Hassan, Z. (2015). A cloud technology migration management strategy model for SMEs in Iraq: An overview. *Journal of Theoretical & Applied Information Technology*, *73*(3), 354-367.

Abubakar, A. D., Bass, J. M., & Allison, I. (2014). Cloud computing: Adoption issues for Sub-Saharan African SMEs. *EJISDC*, 62(1), 1-17.

Agostino, A., Søilen, K. S., &and Gerritsen, B. (2013). Cloud solution in business intelligence for SMEs–vendor and customer perspectives. *Journal of Intelligence Studies in Business*, 3(3).

Ahmad, S. Z., Abu Bakar, A. R., Faziharudean, T. M., & Mohamad Zaki, K. A. (2015). An empirical study of factors affecting e-commerce adoption among small-and medium-sized enterprises in a developing country: Evidence from Malaysia. *Information Technology for Development*, *21*(4), 555-572.

Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Khul & J. Beckman (Eds.), *Action control: From cognition to behavior* (pp- 11-39), Heidelberg, Springer.

Ajzen, I. (1991). The theory of Planned Behavior. *Organizational Behavior and Human Decision Process*, 50(2), 179-211.

Aleem, A., & Ryan Sprott, C. (2012). Let me in the cloud: analysis of the benefit and risk assessment of cloud platform. *Journal of Financial Crime*, *20*(1), 6-24.

Al-Isma'ili, S., Li, M., Shen, J. & He, Q. (2016). Cloud computing adoption determinants: An analysis of Australian SMEs. Pacific Asia Conference on Information Systems 2016 Proceedings (pp. 1-17). United States: AIS Electronic Library.

Alismaili, S., Li, M., Shen, J., & He, Q. (2016). A Multi Perspective Approach for Understanding the Determinants of Cloud Computing Adoption among Australian SMEs. *arXiv preprint arXiv:1606.00745*.

Aljabre, A. (2012). Cloud computing for increased business value. *International Journal of Business and Social Science, 3*(1).

Alotaibi, M. B. (2014). Exploring users' attitudes and intentions toward the adoption of cloud computing in Saudi Arabia: an empirical investigation. *Journal of Computer Science, 10*(11), 2315-2329.

Alshamaila, Y., Papagiannidis, S., & Li, F. (2013), Cloud computing adoption by SMEs in the north east of England: A multi-perspective framework. *Journal of Enterprise Information Management*, 26(3), 250-275.

Anderson, J. C., & Gerbing, D. W. (1988). Structural equation modeling in practice: A review and recommended two-step approach. *Psychological bulletin, 103*(3), 411.

Armbrust, M., Fox, A., Griffith, R., Joseph, A.D., Katz, R., Konwinski, A., Lee, G., Patterson, D., Rabkin, A., Stoica, I. and Zaharia, M. (2010), "A view of cloud computing", Communications of the ACM, 53, 50-58.

Avram, M. G. (2014). Advantages and challenges of adopting cloud computing from an enterprise perspective. *Procedia Technology, 12*, 529-534.

Awa, H. O., Ojiabo, O. U., & Emecheta, B. C. (2015). Integrating TAM, TPB and TOE frameworks and expanding their characteristic constructs for e-commerce adoption by SMEs. *Journal of Science & Technology Policy Management, 6*(1), 76-94.

Bajenaru, A. (2010), "Software-as-a-Service and cloud computing, a solution for small and medium-sized companies", Bulletin of the Transilvania University of Braşov, 3 (52), 173-184.

Barbra-Sanchez, V., Martinez-Ruiz, M. and Jimenez-Zarco, A. (2007), " Drivers, challenges and benefits of ICT adoption by Small and Medium-sized Enterprises(SMEs): A literature review", *Problems and Perspective in Management*, 5(1), 103-113.

Bhagwat, R., & Sharma, M. K. (2007). Information system architecture: a framework for a cluster of small-and medium-sized enterprises (SMEs). *Production planning & control, 18*(4), 283-296.

Bhat, J. M. (2013). Adoption of cloud computing by SMEs in India: a study of the institutional factors. P*roceedings of the Nineteenth Americas Conference on Information Systems, Chicago, Illinois, August 15-17, 2013. 1*

Borgman, H. P., Bahli, B., Heier, H., & Schewski, F. (2013, January). Cloudrise: exploring cloud computing adoption and governance with the TOE framework. In *System Sciences (HICSS), 2013 46th Hawaii International Conference on* (pp. 4425-4435). IEEE.

Bradford, M., & Florin, J. (2003). Examining the role of innovation diffusion factors on the implementation success of enterprise resource planning systems. *International Journal of Accounting Information Systems*, 4, 205-225.

Buyya, R., Yeo, C.S., Venugopa, S., Broberg, J. and Brandic, I. (2009), "Cloud computing and emerging IT platforms: vision, hype, and reality for delivering computing as the 5th utility", Future Generation Computer Systems, 25, 599-616.

Carcary, M., Doherty, E. and Conway, G., 2014. The adoption of cloud computing by Irish SMEs–An exploratory study. *Electronic Journal Information Systems Evaluation Volume*, 17(1).

Cegielski, C. G., Allison Jones-Farmer, L., Wu, Y., & Hazen, B. T. (2012). Adoption of cloud computing technologies in supply chains: An organizational information processing theory approach. *The international journal of logistics Management*, *23*(2), 184-211.

Chau, P. Y., & Jim, C. C. (2002). Adoption of electronic data interchange in small and medium-sized enterprises. *Journal of Global Information Management (JGIM)*, *10*(4), 61-85.

Chau, P.Y. and Tam, K.Y., (1997). Factors affecting the adoption of open systems: an exploratory study. *MIS quarterly*, 21(1), 1-24.

Chong, A. Y. L., Lin, B., Ooi, K. B., & Raman, M. (2009). Factors affecting the adoption level of c-commerce: An empirical study. *Journal of Computer Information Systems*, *50*(2), 13-22.

Chong, A. Y. L., Ooi, K. B., Lin, B., & Tang, S. Y. (2009). Influence of interorganizational relationships on SMEs' e-business adoption. *Internet Research: Electronic Networking Applications and Policy*, *19*(3), 313-331.

Christauskas, C., & Miseviciene, R. (2012). Cloud–computing based accounting for small to medium sized business. *Engineering Economics*, *23*(1), 14-21.

Cohen, J., Cohen, P., West, S.G. and Aiken, L.S. (2002) *Applied Multiple Regression/Correlation Analysis for the Behavioral Sciences, Third Edition*. Taylor & Francis.

Confederation of Indian Industry (2015). MSME Conclave: Facilitating financing and enhancing competitiveness, Theme paper, pp. 6-38.

Cook, N., Milojicic, D., & Talwar, V. (2012). Cloud management. *Journal of Internet Services and Applications*, *3*(1), 67-75.

Cooper, R. B., & Zmud, R. W. (1990). Information technology implementation research: a technological diffusion approach. *Management science*, *36*(2), 123-139.

Dai, W. (2009). The impact of emerging technologies on small and medium enterprises. Journal of Business Systems, Governance & Ethics, 4(4), 53-60.

Davis, F. (1989). 'Perceived Usefulness, perceived ease of use, and user acceptance of information technology'. *MIS Quarterly,* 13(3), 319- 340.

Davis, F. D. (1986). A technology acceptance model for empirically testing new end-user information systems: Theory and results. Doctral dissertation, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

DeFlice, A. (2010). Cloud computing: What accountants need to know. *Journal of Accountancy*, 210(4), 50-55.

Dillon, T., Wu, C. and Chang, E. (2010). Cloud computing: issues and challenges. In *24th IEEE International Conference on Advanced Information Networking and Applications*, pp. 27-33. DOI:10.1109/AINA.2010.187, 2010.

Eder, L. B., & Lgbaria, M. (2001). Determinants of intranet diffusion and infusion. *Omega*, *29*(3), 233-242

Elena, G., & Johnson, C. W. (2015). Factors influencing risk acceptance of Cloud Computing services in the UK Government. *arXiv preprint arXiv:1509.06533*.

El-Gazzar, R., Hustad, E., & Olsen, D. H. (2016). Understanding cloud computing adoption issues: A Delphi study approach. *Journal of Systems and Software*, *118*, 64-84.

Ercolani, G. (2013). Cloud Computing Services Potential Analysis. An integrated model for evaluating Software as a Service. *Cloud Computing*, 77-80.

FICCI (2012). Usage of Information &and Communication Technology (ICT) tools by Indian SMEs and its impact on their business. Available at: http://ficci.in/sedocument/20197/survey-msme.pdf (accessed 6 July 2016)

Fichman, R. G.; Kemerer, C. F. (1997). The assimilation of software process innovations: An organizational learning perspective, *Management Science*, 43(10), 1345–1363.

Fishbein, M. & Ajzen, I. (1975). Belief, attitudes, intention and behavior. Reading, MA: Addison- Wesley.

Frambach, R. T., Wels-Lips, I., & Guendlach, A. (1997). Proactive product service strategies: an application in the European health market. Industrial Marketing Management, 26(4), 341-352.

Gangwar, H., & Date, H. (2016). Critical Factors of Cloud Computing Adoption in Organizations: An Empirical Study. *Global Business Review*, *17*(4), 886-904.

Gangwar, H., Date, H., & Ramaswamy, R. (2015). Understanding determinants of cloud computing adoption using an integrated TAM-TOE model. *Journal of Enterprise Information Management*, *28*(1), 107-130.

Garrison, G., Kim, S., & Wakefield, R. L. (2012). Success factors for deploying cloud computing. *Communications of the ACM*, *55*(9), 62-68.

Géczy, P., Izumi, N. and Kôiti, H. (2012). Cloudsourcing: managing cloud adoption, *Global Journal of Business Research*, 6(2), 57-70.

Gefen, D., Straub, D., & Boudreau, M. C. (2000). Structural equation modeling and regression: Guidelines for research practice. *Communications of the association for information systems*, 4(1), 1-77

George, D., & Mallery, P. (2003). SPSS for Windows step by step: A simple guide and reference. 11.0 update(4th ed.). Boston: Allyn & Bacon.

Ghobakhloo, M., Arias-Aranda, D., & Benitez-Amado, J. (2011). Adoption of e-commerce applications in SMEs. *Industrial Management & Data Systems*, *111*(8), 1238-1269.

Goodburn, M.A. and Hill, S. (2010). The cloud transforms businesses. *Financial Executive*, 26(10), 34-40.

Grandon, E. E., & Pearson, J. M. (2004). Electronic commerce adoption: an empirical study of small and medium US businesses. *Information & management*, *42*(1), 197-216.

Gupta, P., Seetharaman, A., & Raj, J. R. (2013). The usage and adoption of cloud computing by small and medium businesses. *International Journal of Information Management*, *33*(5), 861-874.

Gutierrez, A., Boukrami, E., & Lumsden, R. (2015). Technological, organisational and environmental factors influencing managers' decision to adopt cloud computing in the UK. *Journal of Enterprise Information Management*, *28*(6), 788-807.

Hair, J. F., Jr., R. E. Anderson, R. L. Tatham, and W. C. Black (2006), *Multivariate Data Analysis with Readings*, 6th Edition. Prentice Hall, Englewood Cliffs, NJ.

Hanclova, J., Rozehnal, P., Ministr, J., & Tvrdikova, M. (2015). The determinants of IT adoption in SMEs in the Czech-Polish border areas. *Information Technology for Development*, *21*(3), 426-444.

Hart, P. J., & Saunders, C. S. (1998). Emerging electronic partnerships: antecedents and dimensions of EDI use from the supplier's perspective. *Journal of Management Information Systems*, *14*(4), 87-111.

Hart, P., & Saunders, C. (1997). Power and trust: Critical factors in the adoption and use of electronic data interchange. *Organization science*, *8*(1), 23-42.

Hashim, J. (2015). Information communication technology (ICT) adoption among SME owners in Malaysia. International Journal of Business and Information, 2(2).

Hoberg, P., Wollersheim, J. and Krcmar, H. (2012). The Business Perspective on Cloud Computing - A Literature Review of Research on Cloud Computing. *AMCIS 2012 Proceedings*. Paper 5 http://aisel.aisnet.org/ecis2013/145.

Huang, Z., Janz, B. D., & Frolick, M. N. (2008). A comprehensive examination of Internet-EDI adoption. *Information Systems Management*, *25*(3), 273-286.

Infinedo, P. (2011). Internet/e-business technologies acceptance in Canada's SMEs: An explorative investigation. *Internet Research*, 21(3), 255-281.

INTUIT (2012). Understanding and overcoming barriers to technology adoption among India's micro, small and medium enterprises: building a roadmap to bridge the digital divide. Available at: http://www.intuit.in/images/MSME%20White%20Paper_FINAL.pdf (accessed 5 July 2016)

Jeyaraj, A., Rottman, J. and Lacity, M. (2006),"A review of the predicators, linkages, and biases in IT innovation adoption research", *Journal of Information Technology*, 21(1), 1-23.

Kaiser, H. F. (1974). An index of factorial simplicity. *Psychometrika*, *39*(1), 31-36.

Kale, P., Banwait, S. and Laroiya, S. (2010), "Performa evaluation of ERP implementation in Indian SMEs", *Journal of Manufacturing Technology Management*, 21(6), 758-780.

Kannabiran, G. and Dharmalingam, P. (2012),Enablers and inhibitors of advanced information technologies adoption by SMEs: An empirical study of auto ancillaries in India. *Journal of Enterprise Information Management*, 25(2), 186 – 209.

Katzan, H. (2010), "On the privacy of cloud computing", *International Journal of Management and Information Systems*, 14(2), 1-12.

Kauffman, R. J., Ma, D., & Yu, M. (2014, September). A metrics suite for firm-level cloud computing adoption readiness. In *International Conference on Grid Economics and Business Models* (pp. 19-35). Springer International Publishing.

Khan, N. and Al-Yasiri, A., (2016). Framework for cloud computing adoption: A road map for SMEs to cloud migration. *arXiv preprint arXiv:1601.01608*.

Kim, M., & Park, S. O. (2013). Trust management on user behavioral patterns for a mobile cloud computing. *Cluster computing*, *16*(4), 725-731.

Kleinbaum, D. G., Kupper, L. L., & Muller, K. E. (1988). Applied Regression Analysis and Other Multivariate Methods: Student's Partial Solutions Manual. PWS-Kent.

Kula, V., & Tatoglu, E. (2003). An exploratory study of Internet adoption by SMEs in an emerging market economy. *European Business Review*, *15*(5), 324-333.

Lal, K. (2004). E-business and export behavior: evidence from Indian firms. *World Development*, *32*(3), 505-517.

Lee, Y., Kozar, K. and Larsen, K. (2003), "The Technology Acceptance Model: past, present and future", Communication of the Association of Information Systems, 12, 752-780.

Legris, P., Ingham, J., & Collerette, P. (2003). Why do people use information technology? A critical review of the technology acceptance model. *Information & management*, *40*(3), 191-204.

Li, Y. H. (2008, September). An empirical investigation on the determinants of e-procurement adoption in Chinese manufacturing enterprises. In *Management Science and Engineering, 2008. ICMSE 2008. 15th Annual Conference Proceedings, International Conference on* (pp. 32-37). IEEE.

Lian, J. W., Yen, D. C., & Wang, Y. T. (2014). An exploratory study to understand the critical factors affecting the decision to adopt cloud computing in Taiwan hospital. *International Journal of Information Management*, *34*(1), 28-36.

Lin, A., & Chen, N. C. (2012). Cloud computing as an innovation: Perception, attitude, and adoption. *International Journal of Information Management*, *32*(6), 533-540.

Lippert, S. K., & Govindarajulu, C. (2015). Technological, organizational, and environmental antecedents to web services adoption. *Communications of the IIMA*, *6*(1), 14.

Liu, Z., Min, Q. and Ji, S.(2008), "A comprehensive review of research in IT adoption" Wireless Communication, Networking and Mobile Computing, 2008, 4th International Conference on October 2008, 1-5.

Low, C., Chen, Y., & Wu, M. (2011). Understanding the determinants of cloud computing adoption. *Industrial management & data systems*, *111*(7), 1006-1023.

Lumsden, J. R. I., & Anabel, G. (2013). Understanding the determinants of cloud computing adoption within the UK. Eur*opean, Mediterranean & Middle Eastern Conference on Information Systems 2013(EMCIS2013)* October 17-18 2013, Windsor, United Kingdom.

Maguire, S., Koh, S. C. L., & Magrys, A. (2007). The adoption of e-business and knowledge management in SMEs. *Benchmarking: An International Journal*, *14*(1), 37-58.

Makena, J. N. (2013). Factors that affect cloud computing adoption by small and medium enterprises in Kenya. *International Journal of Computer Applications Technology and Research*, 2(5), 517-521.

Malviya, A., & Chakraborty, N. (2013). Increased MSME and Global Entrepreneurship Due to Cloud Computing. Global Journal of Management and Business Studies, 3(6), 659-666.

Marston, S., Li, Z., Bandyopadhyay, S., Zhang, j. and Ghalsasi, A. (2011). Cloud computing-the business perspective. Decision Support Systems, 51(1), 176-189.

Mazzocchi, M. (2008). *Statistics for marketing and consumer research*. Sage.

Mehrtens, J., Cragg, P. B., & Mills, A. M. (2001). A model of Internet adoption by SMEs. *Information & management*, *39*(3), 165-176.

Misra, S. C., & Mondal, A. (2011). Identification of a company's suitability for the adoption of cloud computing and modelling its corresponding Return on Investment. *Mathematical and Computer Modelling*, *53*(3), 504-521.

Moore, G.C., & Benbasat, I. (1991). Development of an instrument to measure the perceptions of adopting an information technology innovation. *Information Systems Research*, 2(3), 173- 191

Morgan, L., & Conboy, K. (2013). Factors affecting the adoption of cloud computing: an exploratory study. In *Proceedings of the 21st European Conference on Information System*.

Morrison, D. G. (1979). Purchase intentions and purchase behavior. The Journal of Marketing, 65-74.

NASSCOM (2010). A roadmap to enhance ICT adoption in the Indian manufacturing sector. Available at: http://survey.nasscom.in/nmcc-roadmap-enhance-ict-adoption-indian-manufacturing-sector.pdf (accessed 21 March 2012).

Ndiege, J. R. A., Herselman, M. E., and Flowerday, S. V. (2012). Information and communication technologies within small and medium enterprises in developing economies. *African Journal of Business Management*, 6(10), 3576-3582

Neves, F. T., Marta, F. C., Correia, A. M. R., & Neto, M. D. C. (2011). The adoption of cloud computing by SMEs: identifying and coping with external factors.

Nguyen, T. (2008), "Information technology adoption in SMEs: an integrated framework", *International Journal of Entrepreneurial Behaviour and Research*, 15(2), 162-186.

Nguyen, T. H., Newby, M., &and Macaulay, M. J. (2015). Information technology adoption in small business: Confirmation of a proposed framework. *Journal of Small Business Management*, 53(1), 207-227.

NIST (2011), The NIST definition of cloud computing. Available at :http://dx.doi.org/10.6028/NIST.SP.800

Nkhoma, M. Z., Dang, D. P., & De Souza-Daw, A. (2013, May). Contributing factors of cloud computing adoption: a technology-organization-environment framework approach. In *Proceedings of the European Conference on Information Management & Evaluation* (pp. 180-189).

Nunnally, J.C. (1978). Psychometric Theory (2nd Ed.), New York, McGraw-Hill.

Oliveira, T., and Martins, M, F. (2011). Literature review of information technology adoption models at firm level. *The Electronic Journal Information Systems Evaluation*, 14(1), 110- 121.

Oliveira, T., Thomas, M., & Espadanal, M. (2014). Assessing the determinants of cloud computing adoption: An analysis of the manufacturing and services sectors, *Information & Management*, 51(5), 497-510.

Opala, O. J., Rahman, S., & Alelaiwi, A. (2015). The Influence of Information Security on the Adoption of Cloud computing: An Exploratory Analysis. *International Journal of Computer Networks & Communications (IJCNC)*, *7*(4).

Pan, M. J., & Jang, W. Y. (2008). Determinants of the adoption of enterprise resource planning within the technology-organization-environment framework: Taiwan's communications industry. *Journal of Computer information systems*, *48*(3), 94-102.

Park, E., & Kim, K. J. (2014). An integrated adoption model of mobile cloud services: exploration of key determinants and extension of technology acceptance model. Telematics and Informatics, 31(3), 376-385.

Prasad, A., Green, P., Heales, J., & Finau, G. (2014). Towards a Model of Cloud Computing Services for SMEs. In 25th *Australasian Conference on Information Systems Towards a Model of Cloud Computing Services for SMEs* 8th -10th Dec 2014, Auckland, New Zealand.

Prasad, Acklesh & Green, Peter (2015). Cloud computing services for the small and medium enterprises: Key considerations for sourcing sustainable business value. In 2015 *International Symposium on Accounting Information Systems*, 29-30 October 2015, Orlando, FL.

Priyadarshinee, P., Jha, M. K., & Raut, R. (2016). Cloud Computing Adoption in SMEs: A Literature Review. In *Twelfth AIMS International Conference on Management*

Rahayu, R., & Day, J. (2015). Determinant factors of e-commerce adoption by SMEs in developing country: evidence from Indonesia. *Procedia-Social and Behavioral Sciences*, *195*, 142-150.

Ramdani, B., Kawalek, P., & Lorenzo, O. (2009). Predicting SMEs' adoption of enterprise systems. *Journal of Enterprise Information Management*, *22*(1/2), 10-24.

Rana, N. P., Dwivedi, Y. K., Williams, M. D., & Weerakkody, V. (2016). Adoption of online public grievance redressal system in India: Toward developing a unified view. *Computers in Human Behavior*, *59*, 265-282.

Rath, A., Mohapatra, S., and Thakurta, R. (2012). Decision points for adoption of cloud computing in SMEs. *In Internet Technology and Secured Transactions 2012 International Conference for IEEE*, pp. 688-691.

Rogers, E. M. (2003). Elements of diffusion. 5th ed., Free Press, New York, 2003.

Ross, P. K., & Blumenstein, M. (2015). Cloud computing as a facilitator of SME entrepreneurship. *Technology Analysis & Strategic Management*, *27*(1), 87-101.

Ryan, W. M., & Loeffler, C. M. (2010). Insights into cloud computing. *Intellectual Property & Technology Law Journal*, *22*(11), 22.

Saedi, A., & Iahad, N. A. (2013, June). An Integrated Theoretical Framework for Cloud Computing Adoption by Small and Medium-Sized Enterprises. In *PACIS* (p. 48).

Safari, F., Safari, N., & Hasanzadeh, A. (2015). The adoption of software-as-a-service (SaaS): ranking the determinants. *Journal of Enterprise Information Management*, *28*(3), 400-422.

Sahandi, R., Alkhalil, A., & Opara-Martins, J. (2013). Cloud computing from SMEs perspective: A survey-based investigation. *Journal of Information Technology Management*, *24*(1), 1-12.

Salam, A., Gilani, Z., & Haq, S. U. (2015). *Deploying and Managing a Cloud Infrastructure: Real-World Skills for the CompTIA Cloud+ Certification and Beyond: Exam CV0-001*. John Wiley & Sons.

Sallehudin, H., Razak, R. C., & Ismail, M. (2015). Factors influencing cloud computing adoption in the public sector: an empirical analysis. *Journal of Entrepreneurship and Business*, *3*(1), 30-45.

Saunders, M. N. (2011). *Research methods for business students, 5/e*. Pearson Education India.

Seethamraju, R. (2013), "Determinants of SaaS ERP systems adoption", *in PACIS*, available at: http://aisel.aisnet.org/pacis2013/244 (accessed 23 February 2014).

Senyo, P. K., Effah, J., & Addae, E. (2016). Preliminary insight into cloud computing adoption in a developing country. *Journal of Enterprise Information Management*, *29*(4), 505-524.

Shah Alam, S., Ali, M. Y., & Mohd. Jani, M. F. (2011). An empirical study of factors affecting electronic commerce adoption among SMEs in Malaysia. *Journal of Business Economics and Management*, *12*(2), 375-399.

Sharma, M.K., Bhagwat, R. and Dangayach G.S.(2008). Performance measurement of information systems in small and medium sized enterprises: a strategic perspective. *Production Planning & Control: The Management of Operations*, 19(1), 12-24.

Shen, Z., & Tong, Q. (2010). The security of cloud computing system enabled by trusted computing technology. In *Signal Processing Systems (ICSPS), 2010 2nd International Conference on* (Vol. 2, pp. V2-11). IEEE.

Shiralashetti, A.S., (2012). Prospects and Problems of MSMEs in India—A Study. International Journal of in Multidisciplinary and Academic Research, 1(2), 1-7.

Singh, R. K., Garg, S. K., & Deshmukh, S. G. (2009). The competitiveness of SMEs in a globalized economy: Observations from China and India. Management Research Review, 33(1), 54-65.

Smith, R. (2009). Computing in the Cloud. *Research Technology Management*, 52 (5), 65-68.

Srivastva, R.K. and Pandey, R. (2010). Operation Management and information system needs in Indian small and medium enterprises. *2010 Northeast Decision Sciences Institute Proceedings*, March 2010, 117-122.

Stieninger, M., Nedbal, D., Wetzlinger, W., Wagner, G., & Erskine, M. A. (2014). Impacts on the organizational adoption of cloud computing: A reconceptualization of influencing factors. *Procedia Technology*, *16*, 85-93.

Stine, K., Kissel, R.C., Barker, W., Fahlsing, J. and Gulick, J. (2008), Guide for Mapping Types of Information and Information Systems to Security Categories, *US Department of Commerce.*

Straub, D. W. (1989). Validating instruments in MIS research. *MIS quarterly*, 147-169.

Subashini, S. and Kavitha, V. (2011). A survey on security issues in service delivery models of cloud computing. Journal of Network and Computer Applications, 34(1), 1-11.

Sultan, N. (2011). Reaching for the cloud: How SMEs can manage. *International Journal of Information Management*, 31(3), 272-278.

Tan, K., Choy Chong, S., Lin, B., & Cyril Eze, U. (2010). Internet-based ICT adoption among SMEs: Demographic versus benefits, barriers, and adoption intention. Journal of enterprise information management, 23(1), 27-55.

Tan, Margaret; Lin, Trisha T. C. (2012). Exploring organizational adoption of cloud computing in Singapore, *19th ITS Biennial Conference 2012, Bangkok, Thailand, 18 - 21 November 2012: Moving Forward with Future Technologies: Opening a Platform for All*.

Taylor, P. (2015). The importance of information and communication technologies (ICTs): An integration of the extant literature on ICT adoption in small and medium enterprises. *International Journal of Economics, Commerce and Management*, 3(5), 274-295.

Teo, H. H., Tan, B., & Wei, K. K. (1995). Innovation diffusion theory as a predictor of adoption intention for financial EDI. ICIS 1995 Proceedings, 14.

Thakkar, J., Kanda, A., & Deshmukh, S. G. (2008). A conceptual role interaction model for supply chain management in SMEs. *Journal of Small Business and Enterprise Development*, *15*(1), 74-95.

Thompson, B., & Daniel, L. G. (1996). Factor analytic evidence for the construct validity of scores: A historical overview and some guidelines. *Educational and Psychological Measurements*, 56(2), 197-208.

Thong, J. Y. (1999). An integrated model of information systems adoption in small businesses. *Journal of management information systems*, *15*(4), 187-214.

Tornatzky, L., & Fleischer, M. (1990). The process of technology innovation, Lexington, MA. *Lexington Books.*

Trinh, T. P., Pham, C. H., & Tran, D. (2015). An Adoption Model of Software as a Service (SaaS) in SMEs. In *PACIS* (p. 18).

Tripathi, S., & Jigeesh, N. (2015). Task-Technology Fit (TTF) Model To Evaluate Adoption of Cloud Computing: A Multi-Case Study. *International Journal of Applied Engineering Research*, *10*(3), 9185-9200.

Truong, D. (2010), "How cloud computing enhances competitive advantages: A research model for small businesses", The Business Review, Cambridge, 15(1), 59-65.

Tsai, M. C., Lee, W., & Wu, H. C. (2010). Determinants of RFID adoption intention: Evidence from Taiwanese retail chains. Information & Management, 47(5), 255-261.

Venkatesh, V., Morris, M.G., Davis, G.B., & Davis, F.D. (2003). User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27(3), 425-478.

Walterbusch, M., Martens, B., & Teuteberg, F. (2013). Evaluating cloud computing services from a total cost of ownership perspective. *Management Research Review*, *36*(6), 613-638.

Wang, Y. H. (2011, October). The impact of credibility trust on user acceptance of software-as-a-service. In *Nano, Information Technology and Reliability (NASNIT), 2011 15th North-East Asia Symposium on* (pp. 11-16). IEEE.

Wang, Y.-M., Wang, Y.-S. & Yang, Y.-F. (2010). Understanding the determinants of RFID adoption in the manufacturing industry. *Technological forecasting and social change,* 77**,** 803-815.

Wu, W. W. (2011). Developing an explorative model for SaaS adoption. *Expert systems with applications*, *38*(12), 15057-15064.

Wu, W. W., Lan, L. W., & Lee, Y. T. (2011). Exploring decisive factors affecting an organization's SaaS adoption: A case study. *International Journal of Information Management*, *31*(6), 556-563.

Wu, W-W., Lan, L.W., and Lee, Y-T. (2013). Factors hindering acceptance of using cloud services in university: a case study. *The Electronic Library,* 31(1), 84-98.

Wyld, D.(2010), "Cloud computing around the world", Multilingual January/February 2010, 44-48.

Yaw, A. A. S., Twum, F., Hayfron-Acquah, J. B., & Panford, J. K. (2015). Cloud Computing Framework for E-Health in Ghana: Adoption Issues and Strategies: Case Study of Ghana Health Service. *International Journal of Computer Applications*, *118*(17).

Yeboah-Boateng, E. O., & Essandoh, K. A. (2014). Factors influencing the adoption of cloud computing by small and medium enterprises in developing economies. *International Journal of Emerging Science and Engineering*, *2*(4), 13-20.

Yigitbasioglu, O. M. (2015). The role of institutional pressures and top management support in the intention to adopt cloud computing solutions. *Journal of Enterprise Information Management*, *28*(4), 579-594.

Zainuddin, N., Maarop, N., Abidin, W. Z., Azmin, N. F. M., & Samy, G. N. (2015). Cloud Computing Adoption Conceptual Model of Malaysian Hospitals. *Open International Journal of Informatics*, *3*(1), 1.

Zhang, Q., Cheng, L., & Boutaba, R. (2010). Cloud computing: state-of-the-art and research challenges. *Journal of internet services and applications*, *1*(1), 7-18.

Zhu, K., & Kraemer, K. L. (2005). Post-adoption variations in usage and value of e-business by organizations: cross-country evidence from the retail industry. *Information systems research*, *16*(1), 61-84.

Zhu, K., Kraemer, K. L., & Xu, S. (2006). The process of innovation assimilation by firms in different countries: a technology diffusion perspective on e-business. *Management science*, *52*(10), 1557-1576.

Zissis, D., & Lekkas, D. (2012). Addressing cloud computing security issues. Future Generation computer systems, 28(3), 583-592.

APPENDIX
Appendix 1.
QUESTIONNAIRE: Cloud Computing Adoption

This survey is a part of an academic research and the data provided by you will be kept confidential and would be used for this academic research purpose only. You are therefore requested to provide your responses candidly.

PART 'A': Organizational Profile

1. **Name of the organization:**_____

Please tick (✓) against relevant option: Any One Only

Organization's Year of Establishment	**Tick (✓)**		**Total number of employees**	**Tick (✓)**
Less than a Year	1		Less than 25	1
1 – 5 Years	2		Between 25 – 50	2
5 – 10 Years	3		Between 51 – 75	3
10 – 15 Years	4		Between 75 – 100	4
More than 15 Years	5		More than 100	5
Category of Organization	**Tick (✓)**		**Organization's Annual Turnover (In lacs Rupees)**	**Tick (✓)**
Micro Enterprise (Investment in plant & Machinery is up to Rs. 25 Lakh)	1		Up to Rs. 50 lacs	1
Small Enterprise (Investment in plant & Machinery is between Rs. 25 Lakh – Rs. 5 Crore)	2		Over Rs. 50 lacs – Rs. 100 lacs	2
Medium Enterprise (Investment in plant & Machinery is between Rs. 5-10 Crore)	3		Over Rs. 100 lacs – Rs. 500 lacs	3
Large Enterprise (Investment in plant & Machinery is above10 Crores)	4		Over Rs. 500 – Rs. 1000 lacs	4
			Over Rs. 1000 lacs	5
Which of the following phrase best describe regarding cloud computing for your firm	**Tick (✓)**		**Clientele Base of Organization**	**Tick (✓)**
We have already adopted cloud computing	1		Local	1
We are using on trial basis	2		Regional	2
We are planning to adopt cloud computing in the next 2-3 years	3		National	3
Not Applicable (N/A)	4		International	4

Please tick (✓) against relevant option(s): More than one if applicable

How do you procure software to be used in the company?	**Tick (✓)**		**In which industry does your company operate**	**Tick (✓)**
Only original software through vendors	1		Auto Components	1
Purchase online	2		Metal products	2
Copied from friends and through personal contacts	3		Pharmaceutical and Biotech	3
From local vendors	4		Packaging	4
Any Other (please specify): ……	5		Food & Agro Products	5
Which IT application/service you are most likely to adopt through cloud computing?	**Tick (✓)**		Basic Chemical and Chemical Products	6
Individual software packages (like tally, ERP etc.)	1		Scientific Instruments	7
Infrastructure services such as storage and network capacity	2		Engineering, Electricals & Electronics	8
A complete operating system and software package available via cloud services	3		Any Other (please specify):	9

Security services in the cloud	4			
Any Other (please specify): ……...	5		…… ……..	

Indicate the availability of IT infrastructure in your Company by ticking the appropriate boxes. Kindly also specify the number under the heading "Hardware":

Hardware				**Software**				**Internet Connection**			
Desktop Computer	**Laptop**	**Smart Phone**	**Other (Specify)**	**MS-Office**	**Own Web-site**	**Accounting Software**	**Other (Specify)**	**Dial-up**	**Wireless Modem**	**Leased Line/DSL**	**Other (Specify)**
No.	**No.**	**No.**	**No.**								

PART 'B'

This part of the survey explores the factors that affect the adoption decision of cloud services within firms. Please indicate the extent to which you agree with each of the following statements by ticking (√) in the appropriate box

Q. No.	**Questions Related to Individual Factors**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
1	Cloud computing services enable us to accomplish tasks more quickly					
2	Cloud computing services will increase productivity					
3	Using cloud computing services give us greater control over our work.					
4	Using cloud computing services would make my job easier					
5	Learning to operate cloud computing services would be easy					
6	Our interaction with cloud computing services would be clear and understandable					
7	It would be easy for us to become skilful at using cloud computing services					
8	Overall we would find cloud computing services easy to use					
Q. No.	**Questions Related to Technological Factors**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
9	With cloud computing it is easy to 'scale-up' or 'scale-down' IT resources as per requirements.					
10	Use of cloud computing services reduces upfront costs (Initial investment on IT)					
11	Upgrading/updating & maintenance of hardware & software is easy with cloud computing					
12	Back-up & disaster recovery capabilities are better while using cloud computing					
13	By using cloud computing we can easily get access to latest information technologies.					

14	Using cloud service is compatible with all aspect of our work					
15	Usage of cloud computing service fits well with the way we like to work					
16	Cloud computing created changes are compatible with our business					
17	Cloud computing is compatible with our existing technology infrastructure					
18	The security systems built into the cloud computing services are strong enough to protect our data					
19	The confidentiality of business data is guaranteed when using cloud computing services					
20	I am confident that cloud providers will not use my company's data for their own commercial benefits.					
Q. No.	**Questions Related to Organizational Factors**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
21	Top management's attitude is positive towards using cloud computing					
22	Top management supports the implementation of cloud services					
23	Top management is ready to provide necessary resources for the introduction of cloud computing					
24	Top management accepts possible risks, which may result from introducing cloud computing					
25	When we come to know about new information technology, we would look for ways to experiment with this new IT.					
26	Among peers, our firm is usually the first to adopt new information technologies.					
27	Cloud computing is a familiar type of technology to use					
28	Overall, my organization has enough technical knowledge regarding technologies similar to cloud computing					
Q. No.	**Questions Related to Environmental Factors**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
29	My company may acquire competitive edge if we use cloud computing					
30	Competition may prove to be an important factor in our decision to adopt cloud computing					
31	Our business partners are already using cloud computing					
32	Our industry is pressuring us to adopt cloud computing					
33	Cloud service provider's reputation is an important factor while deciding about cloud computing implementation					
34	It is necessary to have adequate technical support after adoption of cloud computing services.					

35	It is important to have a good relationship with cloud service providers.					
36	Assuming we have access to cloud computing, we intend to use it.					
37	Given that we have access to cloud computing , we predict that we would use it					
38	Given easy access to cloud computing, I will recommend cloud computing implementation in my company.					

PART 'C' (Personal Detail)

Name of Respondent	**First Name**	**Last Name**
Gender	**Male:** ☐ **Female:** ☐ **(Put ✓ in the correct box)**	
Designation		
Department		

Organization's Address	
Website URL	
E – Mail	
Telephone No. / Mobile No.	

Please tick (✓) against relevant option

Working in Current Organization from:		**Age**		**Educational Qualification**	
Less than 1 Year		20-30 Years		Class10th Pass	
1 – 5 Years		30-40 Years		Class 12th Pass	
5 – 10 Years		40-50 Years		Graduate	
More than 10 Years		Above 50 Years		Post Graduate	

SPACE FOR ATTACHING YOUR VISITING CARD (OPTIONAL)

APPENDIX 2
RELATED PUBLICATIONS

Refereed Journals

Kumar, D., Samalia, H. V. and Verma, P. (2017). "Factors Influencing Cloud Computing Adoption by Small and Medium-Sized Enterprises (SMEs) In India," *Pacific Asia Journal of the Association for Information Systems, 9*(3), pp. 73-96.

Kumar, D., Kumar, D., Samalia, H. V., Samalia, H. V., Verma, P., & Verma, P. (2017). "Exploring suitability of cloud computing for small and medium-sized enterprises in India," *Journal of Small Business and Enterprise Development*, *24*(4), 814-832.

Kumar, D., Samalia, H. V., Verma, P., & Singh, H. (2013), "Stumbling Blocks in Cloud Computing Adoption Pathway: A Charter", *Computer Technology and Application (David Publishing USA),* 4 (2013), pp. 635-642.

Refereed Conference Papers

Kumar, D., Samalia, H.V. and Verma, P. (2013), "Assessing the Relevance of Cloud Computing for Micro, Small and Medium Enterprises in India", International Conference on Entrepreneurship for the XXI century - images and perspectives, November 16-17, 2017, University of Warsaw, Poland.

Kumar, D., & Samalia, H. V. (2016, October). "Investigating factors affecting cloud computing adoption by SMEs in Himachal Pradesh", In Cloud Computing in Emerging Markets (CCEM), 2016 IEEE International Conference, Bangalore, India on (pp. 9-16). IEEE.

Kumar, D., Samalia, H.V. and Verma, P. (2013), "Impediments in the path of cloud computing augmentation", International Conferencse on Cloud, Big Data and Trust 2013, Nov. 13-15, Rajiv Gandhi Proudyogiki Vishwavidyalaya (RGPV), Bhopal, India.